

80micro

December 1983 USA \$4.00

(the magazine for TRS-80 users)

Assembly Made Easy

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How to Thwart
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A CP/M Board?

The Road to A-L
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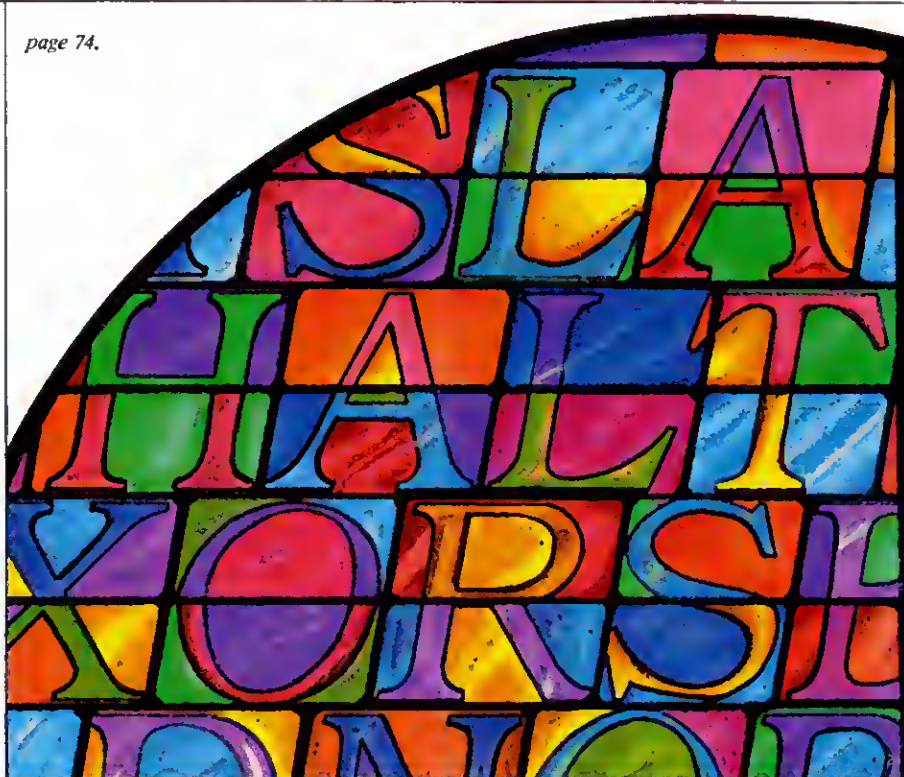
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Editorial:
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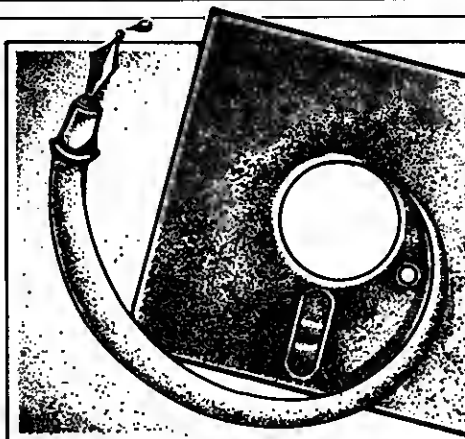
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We've already seen one so-called revolution fail. It evaporated into thin air shortly after Kent State, unable to bear the weight of its own rhetoric. So pardon me if I'm skeptical about this latest revolution supposedly being fomented by the personal computer.

At least, the media and self-styled experts on social change are calling it a revolution. If so, it's got to be the happiest one in the history of the world. It sparkles beneath a California sun that shines like a big yellow smile button. It glows brightly from the pages of *Newsweek* and *The New York Times*, from quarter-million dollar television commercials, from the zippy pop-computer magazines that hang fat and lazy from the newsstands.

Here is one revolution that promises to do you no harm. Nobody gets hurt, nobody gets agitated. With the exception of a few malcontents, nobody even gets upset.

I can't claim to be an expert on revolutions, since I've never been in one. But it's my understanding that a revolution is aimed at the fundamental concepts upon which a political or social structure is built. Take the Industrial Revolution, for example. It caused social and economic upheaval on a massive scale. It shifted power from the land-owners to the factory owners, from the rural areas to the cities, and completely changed the way people lived and worked.

But the microcomputer revolution is another story. It does nothing to challenge the basic relationship between people and their supporting institutions. It does not change the make-up of the ruling class, nor does it alter our perceptions of that class.

Some people say that microcomputers will give us more control over our lives, that computers will let us access information heretofore available only to the rich and powerful. This may, to some extent, be true; if information is power, greater access to information means greater power. But if the average

America's happiest revolution

citizen gains a little, the ruling class will gain a good deal more.

Ultimately, computers will serve to reaffirm the social and political hierarchies in this country. The strong will be stronger and the weak weaker, a trend that hardly can be called revolutionary.

Adam Osborne has been one of the micro industry's most caustic critics. So more than a few people chortled when Osborne Computer Corp. collapsed last summer.

In some respects, Osborne comes out looking like a fool. When he introduced the Osborne, he let loose a barrage of criticism at his fellow manufacturers, predicting in the May 1981 issue of *Microcomputing* that "their unrealistic perspective will trigger disaster with all the tragic ruthlessness that early success had on such companies as Imsai and Processor Technology."

But Osborne's failure was not due to lack of insight. In retrospect, his comments in that article often hit the mark. "Hardware manufacturers must concentrate on driving down the price of hardware," he warned. And further on, he predicted "a new, massive round of hardware price reductions."

Osborne also saw the impact his new

computer would have on the micro market, and predicted "a rapid evolution of new, low-cost portable microcomputers that appeal to individuals and are used with the frequency of typewriters." And, in a forecast fraught with irony, he saw that by 1983 the Osborne would "have a lot of company."

Finally, though IBM had not yet entered the arena, Osborne saw the eventual establishment of industry-standard software and hardware. "Those who stray from industry standards will be forced to leave the microcomputer marketplace," he said.

Osborne's sin was that he was as lousy a businessman as the early losers he criticized. And apparently, the major manufacturers were not as misguided as he thought they were. Ultimately, they changed their ways, learning to see and respond to shifts in the marketplace.

Osborne was an important stimulus to those changes. He may not have practiced what he preached, but he had a major impact on the industry and the way it sold itself. He should be given appropriate credit.

Last week at the Peterborough Diner, I gave the cashier \$2 for a \$1.95 turkey sandwich. The computerized cash register credited me with 9 cents' change. The waitress dutifully gave me a nickel and four pennies.

"Wait a minute," I said, and pointed out that \$2 minus \$1.95 was not 9 cents. She puzzled over the problem for a moment, finally saw the light, and took back the surplus change.

This little tale has several morals. First, we must retain our ability to do simple math.

Second, we must not believe everything the computer says, or let it subvert our common sense.

And third, we must be watchful consumers. As long as human beings punch the buttons, the buyer's motto remains "caveat emptor." ■

A photograph of a gorilla sitting in a grassy field. The gorilla is dark-furred and is positioned in the center of the frame, facing slightly to the right. It appears to be sitting on the ground. The background is filled with tall green grass and numerous small red flowers, possibly poppies, which are scattered throughout the scene. The lighting is bright, suggesting a sunny day.

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Speaking in hex

You asked for it, though in a round-about fashion and probably without your knowing it. *80 Micro's* readership surveys tell us a lot about your needs. One thing we've noticed is your growing interest in Assembly language. This isn't too surprising since most of you (88.5 percent to be exact) use your TRS-80 for home or hobby applications. And we all know what that means: software programming.

Designing and writing software, especially games, is both fun and rewarding. It can also be frustrating. There's nothing worse than programming a fantastic game in Basic only to have it run as slow as molasses uphill. Screen changes take seconds and your rockets never quite seem to reach their targets in time. This is usually when your interest in Assembly language begins to take root and grow. This issue will nurture that growth.

Communicating with your computer in a high-level language like Basic is like talking with someone who speaks a foreign language. When you say goodbye to a Frenchman, he has to use a dictionary to see that you mean *au revoir*. The computer follows the same process. If you write a Basic instruction in your program, the computer has to translate this instruction to its "native tongue," machine code.

When you use a low-level language like Assembly language, the interpretive process is greatly simplified. The computer operates on Assembly-language instructions much faster because that language is closer to the Z80's machine code.

Assembly-language programs execute up to 300 times faster than Basic. They also require less memory: you can run an Assembly-language program in 4K that normally requires 24K in Basic. And if you ever had an urge to see how the Z80 processes all of those routines in ROM or TRSDOS, Assembly language lets you do that as well.

Assembly language can be intimidating at first with its extensive use of binary and hexadecimal data. But be assured that it's no more difficult to learn than when you mastered Basic years ago. To ease your nerves, and to help build your confidence, we've put together a collection of articles that cover the entire spectrum of Assembly language. Whether you're a neophyte testing the waters, or an advanced programmer doing the backstroke, you'll find something to meet your needs between this month's covers.

For example, Hardin Brothers presents his first installment of *Assembly Language Made Simple* for this issue. In this comprehensive piece he gently introduces you to your first dose of Assembly language. And since everyone loves to learn shortcuts, Bob Bowker continues to share some of his secrets with us. You'll find them in part two of his article, *Assembly-Language Shortcuts* (p.). They are especially useful for those of you who've been introduced to the language.

Other articles of interest include David Haan's technique titled *Assembly Language Disk I/O*, Terry Kepner's feature review, *CP/M III Ways*, and Joseph Trojak's *Finding the Search Solution*, a program that lets you search text files quickly. And when the day ends, you can relax in your easy chair and watch one of over 140 TV channels, made available with help from Dan Keen and Dave Dischert's article, *Channels of Communication*. If you don't want to sit in front of the boob tube all night, there's always the antics of the Gamer's Cafe to keep you smiling. So sit back and enjoy! ■

—S.F.T.
01010000

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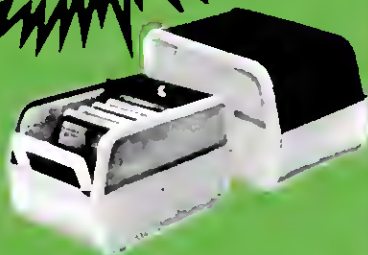
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INPUT

MaxiStat Now StatPac

John Harrell did an excellent job reviewing MaxiStat (September 1983, p. 50).

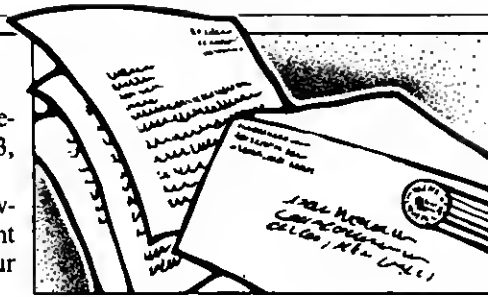
Your readers should be aware, however, that we have made important changes relative to MaxiStat since your review appeared.

MaxiStat is no longer published or marketed by The Business Division. Walonick Associates now markets and supports an updated version of the package under its original name of StatPac.

This update contains substantial changes from the version you reviewed, including more statistics, printing options, and machine-language subroutines for speed.

Anyone interested in further information should contact Walonick Associates.

*David S. Walonick
President, Walonick Associates
5624 Girard Ave. South
Minneapolis, MN 55419*



Printer Fix

The DMP200 printer has one drawback: Its superscripts are low, and the rest of the text after a subscript is noticeably lower than the text preceding the subscript.

To rectify this, change the half-reverse line feed action to a full-reverse line feed followed by a half-forward line feed (see Program Listing 1). This has an insignificant effect on print speed, and it works.

This fix also works on the Radio Shack Line Printer VIII, and with other Radio Shack printers that use the same printer drivers.

To install this modification, define

```
PATCH DMP400/CTL (ADD=BCAC,FIND=1C,CHG=0A)
PATCH DMP400/CTL (ADD=BCB0,FIND=C9,CHG=00)
PATCH DMP400/CTL (ADD=BCB8,FIND=1E,CHG=1C)
PATCH DMP400/CTL (ADD=BB4D,FIND=A5,CHG=B1)
PATCH DMP400/CTL (ADD=BB50,FIND=B1,CHG=A5)
PATCH DMP400/CTL (ADD=BC76,FIND=B1,CHG=A5)
PATCH DMP400/CTL (ADD=BC82,FIND=A5,CHG=B1)
```

OR

```
PATCH LP8/CTL (ADD=BC9E,FIND=1C,CHG=0A)
PATCH LP8/CTL (ADD=BCA2,FIND=C9,CHG=00)
PATCH LP8/CTL (ADD=BCAA,FIND=1E,CHG=1C)
PATCH LP8/CTL (ADD=BB4D,FIND=97,CHG=A3)
PATCH LP8/CTL (ADD=BB50,FIND=A3,CHG=97)
PATCH LP8/CTL (ADD=BC68,FIND=97,CHG=A3)
PATCH LP8/CTL (ADD=BC74,FIND=97,CHG=A3)
```

Program Listing 1. Patch for the DMP200 printer.

```
900 BK$ = CHR$(255)+CHR$(255)+CHR$(255)
910 SP$ = CHR$(128)+CHR$(128)+CHR$(128)
920 TB$ = CHR$(27)+CHR$(16)+CHR$(0)+CHR$(48)
1000 LPRINT CHR$(10);
1010 FOR H = 0 TO 47
1015 LPRINT TB$;
1020 FOR W = 0 TO 127
1030 IF POINT (W,H) THEN LPRINT BK$; ELSE LPRINT SP$;
1040 NEXT W
1050 LPRINT ""
1060 NEXT H
```

Program Listing 2. LPVIII print adjustment.

the user print code as the control-@ key sequence, since the @ key is close to the * key. Use the System Set-up option from the main menu and then the Enter Printer Codes option.

Under the @ key, enter 0 for the units and 27,10,27,28 for the sequence of codes.

You can also change printer driver DMP400/CTL or LP8/CTL by replacing the half-reverse line feed code with the code for a full-reverse line feed followed by a half-forward line feed (second half of Listing 1). This lets you use the control-* code exactly as normal, and there is no interference with any observable function of SuperScript 1.1.

You must type in the patches exactly as shown below, and only to your backup copies of the program (building a do-file is a very convenient way to save on repeated typing).

*Ian McCauley
Department of Biochemistry
University of Western Australia
Nedlands, 6009*

LPVIII Expanded Graphics

In Jim Hanson's letter to Input (June 1983, p. 12), his program to display screen graphics to the LPVIII prints graphics horizontally shortened by one third.

Program Listing 2 is a modification to Hanson's program that solves this problem. Lines 900 and 910 define the block and space print location. Line 920 defines the tab (LPVIII POS command) to center the display on the page.

*Don Moore
P.O. Box 1405
Coconut Grove, FL 33133*

Machine-Specific Programs

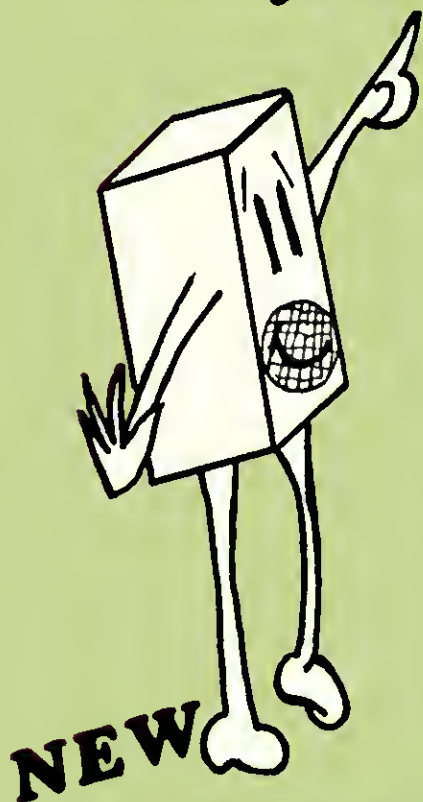
I am distressed by the concept, stressed throughout *80 Micro*, that every program published must be compatible with both the Model I and Model III.

Most of the programs in your magazine that run on the Model III also run on a Model I, and it's the same story for many software companies.

The reasons for this phenomenon are simple and well intentioned: Having the same program work on both machines satisfies twice as many people, means

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Error Trap

In our "Buyer's Guide to Disk Drives and Disks" (June 1983, p. 234), we omitted Micro Design. Micro Design (6301 Manchaca Road, Austin, TX 78745, 800-531-5002) markets one 40-track, 5¼-inch disk drive for the Model I, and three systems for the Model III.

Micro Design offers 40-track, single-sided 5¼-inch disk drives with 250K storage capacity (first upgrade is \$399, second internal drive is \$189.95). Also available are 40-track, double-sided disk drives with 500K storage capacity (first drive upgrade is \$474, second drive is \$274), and 40-track, 5¼-inch, double-sided drives with 500K storage capacity (disk drive upgrade is \$495, additional slim line drive is \$295).

In the September Input column (p. 12), we omitted the program listing for Howard Potvin's letter. Program Listing 6 eliminates the extra alpha column headings in John Corbani's Minicalc program (May 1983, p. 140).

Line 470 contains the code to set an Epson printer to 132 characters per inch, and Potvin changed the reference to the number of columns in line 110 from 14 to 15. Line 475 sets unidirectional printing and checks for number of columns.

If you have eight or fewer columns, set Q to 1 and drop to line 480. If you have more than eight, set Q to 9 and go to line 476 to print the first eight columns. Then go to line 480 and print the rest. Line 49 keeps the underline length correct.

These changes print the full 16 columns by 26 rows on one sheet of standard sized paper.

Richard Green's review of Power DOT (October 1983, p. 80) contains a minor error. On page 84, the two angles referred to as 150 degrees are actually 15 degrees.

you have to write only one version of the program, and guarantees that you can keep the software if you upgrade from a Model I to a Model III.

I cannot help thinking, however, that this practice is short-changing owners of Model IIIs and modified Model I's. These programs don't let me use my special features at all.

As an example, Radio Shack obviously designed its Series I Editor/Assembler for a Model I. Only the left shift key works, and I must use the low cassette speed. To generate lowercase characters, I have to depress the shift key.

Ideally you should have two versions of the same program, each designed for its own individual machine. An excellent example of this is Frolic, the machine-language monitor contained in the book *TRS-80—More Than Basic*, by John Froehlich.

Mr. Froehlich wrote two different monitor programs, one for each model, each version using its own model's special features. Why can't major software manufacturers do this as well?

I urge the editors of *80 Micro* to encourage machine-specific program submissions. Once you have such programs, you could convert them, much the same as you do in the Take II column.

I have used both the Model I and the Model III, and it isn't difficult to alter existing generic programs to fully utilize each machine's specialties.

Once people stop bunching together the Model I and III as one machine, the owners of both will be better off. However, the trend does not seem to be in that direction.

A serious flaw in Model 4 Basic is the

necessity of separating each Basic key word with a space. Will programs published in the future in magazines and on disk and tape have spaces between each keyword, to make every program compatible with that machine too? I sincerely hope not.

Mark Allen Reed

Box 459-A

Lyme Center, NH 03769

AIDS-III Space Saver

Although the AIDS-III packages published in the March and April 1983 issues (p. 136 and p. 168, respectively) of *80 Micro* are the most useful to be found, they take up a lot of disk space.

I've come up with a way to save a great deal of disk space and keep several files on one disk.

Make up individual data lists (all starting at line 5000) and save them as ASCII files (use the ,A option). Then make up a menu for the programs you've developed (see Program Listing 3), plug the menu into lines 1-7 of the AIDS package, and you can use the same basic AIDS program to load any number of data files.

After you type in RUN, the program asks if you've loaded a program yet. Answer anything but Y. The program then brings up the menu. By selecting the number of the desired data file, you can merge it with the original AIDS package. At the ready prompt, type RUN, answer Y this time, and press the enter key.

Using this procedure, I'm able to get AIDS-III, MAPS-III, MERGE-III, CALCS-III, and eight data files (saved in ASCII), their descriptor files, and their record files on one disk.

```
1 CLS:PRINT$596, "HAS A PROGRAM BEEN LOADED YET?": INPUT A$: IF
A$="Y" THEN 18 ELSE 3
2 CLS:PRINT$74, "THE FOLLOWING PROGRAMS ARE DEVELOPED.": PRINT$2
$2, "1. VIDEO LISTINGS.": PRINT$266, "2. FOOD CABINET INVENTORY.":
PRINT$338, "3. FREEZER INVENTORY.": PRINT$394, "4. FRIENDLY PARTIES
.": PRINT$458, "5. HOUSEHOLD INVENTORY.":
4 PRINT$522, "6. SUBORDERS.": PRINT$586, "7. UNDEFINED.": PRINT$65
8, "8. EXIT PROGRAM.": PRINT$842, "SELECT CHOICE...": INPUTN: IFN<
10RN>8 THEN CLS: GOTO 3 ELSE CLS
5 IFN=1 THEN PRINT$596, "MERGING VIDEO PROGRAM": MERGE "VIDEODES/F
IL" ELSE IFN=2 THEN PRINT$596, "MERGING FOOD CABINET PROGRAM": ME
RGE "FOODES/FIL" ELSE IFN=3 THEN PRINT$596, "MERGING FREEZER PRO
GRAM": MERGE "FREEZDES/FIL" ELSE 6.
6 IF N=4 THEN PRINT$596, "MERGING FRIENDLY PROGRAM": MERGE "FRENDD
S/FIL" ELSE IFN=5 THEN PRINT$596, "MERGING INVENTORY PROGRAM": ME
RGE "ROUSEDDES/FIL" ELSE IFN=6 THEN PRINT$596, "MERGING SUBORDER PRO
GRAM": MERGE "SUBSDDES/FIL" ELSE 7
7 IF N=8 THEN STOP: ENDELSEIF N>8 ORN<8 THEN CLS: FORI=1 TO 188: PRI
NT$596, "UNDEFINED...": NEXTI: GOTO 3
```

Program Listing 3. Menu for the AIDS-III program.

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Compatibility: Newclock-80 is compatible with any operating system, including DOSPLUS, NEWDOS, LDOS. With its fully decoded circuitry it will work with any other hardware you may own. Bus expanders are available.

Installation is very simple, no tools, no disassembly, no soldering. Just plug it in, that's all. There is no power supply or messy cable. Newclock-80 plugs into the rear of the keyboard ③ or side of the Exp. Int. ②. Model III Newclock fits the 50 pin card edge (underneath) ①.

The Software: Newclock-80 is as easy to use as it is to install. "SET", a Basic program, is used only once to set the time and date and select 12 or 24 hour format. "TIMESTR", also in Basic, patches your computer "TIMES" function to read Newclock-80. It also adds "TIMES" to keyboard-only systems, a short routine is simply "poked" into low memory.

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Now if someone can show me a way to get Basic to run after a merge without typing in RUN, I'd really be happy!

James T. Krywalski
80 Lockwood Ave.
Buffalo, NY 14220

AIDS-III Error

An error exists in the lowercase support program modifications that appeared in the August 1983 issue of *80 Micro* (p. 12). The modifications support the lowercase characters, but disable the up-arrow (K1) key so it no longer functions to move the cursor to the previous entry lines.

I corrected this by adding and changing the following program lines to the AIDS-III program, in addition to making the changes that appeared in the August 1983 issue.

```
170 IFIC=91THENIC=6
2000 US=CHR$(91): CCS=US+ CHR$(K2)+
      CHR$(K5)+ CHR$(K6)+ CHR$(K9)
3744 DATA 13,6,10,8,9,27,26,24,25,31,3
```

I use 123 instead of 6 in lines 170 and 3744, but suggest the use of 6. It's shorter and appears to work, although I haven't tested it thoroughly.

Also, line 640 of the August modifications for AIDS-III has a slight error in the last statement. SV = FV\$ should read SV\$ = FV\$ to conform with the original program and the MAPS-III and CALCS-III changes.

Darrell Lee
The Food and Drug Administration
c/o Administration Building,
Room 1033
1745 W. 1700 South St.
Salt Lake City, UT 84104

Maze Chase PEEK

The changes in Program Listing 4 are for Leonard Karr's Maze Chase game (August 1983, p. 272). They let you hold one key down and continue to move until you release the key.

Mike Cessna
610 N. 54th St.
Springfield, OR 97477

High-Speed POKE

For the Model 4 owner, Model III software operates at the Model 4's higher speed by utilizing the following

POKE from Basic:
POKE 16912,104 (to speed up)
POKE 16912,40 (to slow down)

When assembled, the source code in Program Listing 5 permits toggling the

speed-up off and on from the DOS READY command line.

R. L. Stuart
15434 Sherman Way
Van Nuys, CA 91406

More on the Model 4

Regarding the Model 4 review, "Once More, with Feeling" (August 1983, p. 100), I've found that other commands not supported by Microsoft Basic 5.0 include Set, Reset, and Point, limiting graphics production.

Also, space delimiters required after reserved words in Microsoft Basic 5.0 don't take up additional memory. The program removes these spaces when it converts Basic commands to single-byte tokens, and they are restored at print or list time.

It is true that the conversion utility (CONV) lets you copy files from TRS-DOS 1.2 and 1.3 formatted disks to TRSDOS 6.0 formatted disks. However, this conversion is of minimal help in converting Model III Basic to Microsoft Basic 5.0 because mapping Basic commands to single-byte tokens is entirely different in the two Basics.

Finally, my greatest frustration is the unavailability of the *Model 4 Technical Reference Manual* referred to in the *Model 4 Disk System Owner's Manual*. Without this manual, it's impossible to interface Assembly language with either the Model 4 hardware, or with TRSDOS 6.0.

Gregory E. Nutt
23 Pendleton Lane
Londonderry, NH 03053

```
2100 L=PEEK(14400)
2110 IF L=0ANDPEEK(S+PL-64)...
2120 IF L=32ANDPEEK(S+PL-3)...
2130 IF L=16ANDPEEK(S+PL+64)...
2140 IF L=64ANDPEEK(S+PL+3)...
3070 PRINT"      UP ARROW MOVES YOU UP"
3080 PRINT"      DOWN ARROW MOVES YOU DOWN"
3090 PRINT"      LEFT ARROW MOVES YOU LEFT"
3100 PRINT"      RIGHT ARROW MOVES YOU RIGHT"
```

Program Listing 4. PEEK for Maze Chase.

```
00100 ; *****
00110 ; *          SPEED/SRC          *
00120 ; * Speed Toggling Program   *
00130 ; * For Model III Software  *
00140 ; * Used on TRS-80 Model 4  *
00150 ; *****
00160 ;
00170 ; ORG      0FF00H          ;PROGRAM LOAD ADDRESS
00180 ; LO      HL,16912        ;HL POINTS TO SPEED ADDRESS
00190 ; LD      A,(16912)       ;A=VALUE IN SPEED ADDRESS
00200 ; CP      104             ;IS IT 104? (HIGH)?
00210 ; JP      Z,LP1           ;IF HIGH, JUMP LP1 FOR LOW
00220 ; LD      (HL),104        ;IF LOW, MAKE HIGH
00230 ; JP      LP2            ;AND JUMP LP2 TO EXIT PGM.
00240 ; LD      (HL),40         ;IF HIGH,MAKE LOW (40)
00250 ; JP      402DB          ;JUMP TO DOS READY
00260 ; END      0FF00H
```

Program Listing 5. Speedup toggling program for the Model 4.

```
470 IFPEEK(14312)<>61THEN PRINT@960, "PRINTER NOT READY";GOTO 470
ELSE LPRINT CHR$(15)TAB(10) TYS:LPRINT
475 LPRINT CHR$(27) "U":IFMV<0THENQ=1:GOTO400 ELSE Q=9
476 LPRINT TAB(5);:FORR=1 TO 0:LPRINT"      CHR$(R+64) "
":NEXT:LPRINT:LPRINT:FORAS=1 TO MV+1:LPRINT TAB(5) A5TAB(9)
":FORR=1 TO 0:TS=MID$(A5(A5),R*15-13,14):GOSUB 510:NEXT:LPRINT
477 IF A5=MHLPRINT TAB(5) STRING$(120,"-")
478 NEXT:LPRINT:LPRINT:LPRINT
480 LPRINTTAB(5);:FOR R=Q TO MV+1:LPRINT"      CHR$(R+64) "
":NEXT:LPRINT:LPRINT:FOR AS=1 TO MV+1:LPRINTTAB(5)
) A5 TAB(9);:FOR R=Q TO MV+1:TS=MID$(A5(A5),R*15-13,14):GOSUB 5
10:NEXT:LPRINT
490 IF A5=MHLPRINTTAB(6) STRING$(15*(MV-Q+2),"-")
500 NEXT:LPRINT:LPRINT:LPRINT:RETURN
510 V=VAL (TS): IF V=0 LPRINT" TS;:RETURN
520 LPRINTUSING "00000000.00";V;:LPRINT"      ";:RETURN
```

Program Listing 6. Adjustment program for Minicak.

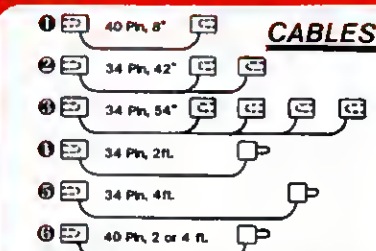
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- Several are just a flat piece of standard colored Lucite. The green tint was not made for this purpose and is judged by many to be too dark. Increasing the brightness control will result in a fuzzy display.
- Some are simply a piece of thin plastic film taped onto a cardboard frame. The color is satisfactory but the wobbly film gives it a poor appearance.
- One "optical filter" is in fact plain acrylic sheeting.
- False claim: A few pretend to "reduce glare" in fact their flat and shiny surfaces (both film and Lucite type) ADD their own reflections to the screen.
- A few laugh: One ad claims to "reduce screen contrast". Sorry gentleman but it's just the opposite. One of the Green Screen's major benefits is to increase the contrast between the text and the background.
- Drawbacks: Most are using adhesive strips to fasten their screen to the monitor. This method makes it awkward to remove for necessary periodical cleaning. All (except ours) are flat. Light pens will not work reliably because of the big gap between the screen and the tube.
- Many companies have been manufacturing video filters for years. We are not the first (some think they are), but we have done our homework and we think we manufacture the best Green Screen. Here is why:
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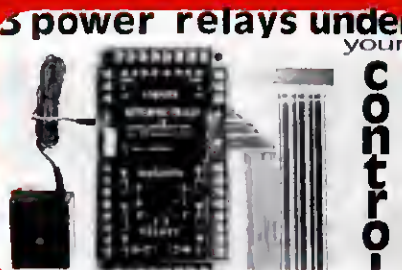
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Selecting Records

I'd like to select records in a variables file when merging with the master file in Scripsit. Does anyone know of a program that will accomplish this? It would also be nice if the selection criteria could accommodate more than OR or AND connectives.

*Paulo Guarinello
Emiliano Perneta, 837/802
Curitiba, Parana
Brazil*

Up and Running

Can someone help me get MicroSoft's Level II Basic Compiler up and running on a Model III?

*John S. Letcher Jr.
P.O. Box 104
Southwest Harbor, ME 04679*

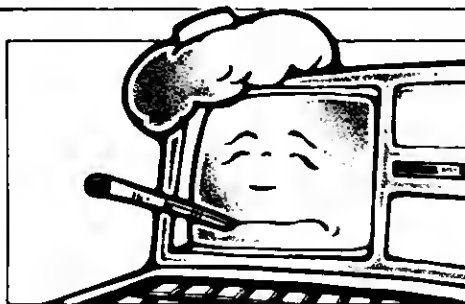
Line-Renumbering Program

I have a Model III cassette operating system. After writing lengthy programs in Basic, I desperately need a line renumbering program. Does anyone know where I can get such a program?

*Robert Leland
737 Knollwood Lane
San Dimas, CA 91773*

Sell Me Yours

I can't find Microsoft's Extended



Searching for answers

muMath for the Model III anywhere. Does anyone know where I can get a copy? If you're willing to sell yours, contact me.

*Kenneth Meyer
1314 Ault View Ave.
Cincinnati, OH 45208*

Needs a Conversion Program

I have been using a Wang 2200 B system for several years, and now that I have a Model II, I have no way to access my engineering programs on the Wang

disks. I'd like to know if there's a reformatter/conversion program available that can exchange data files from Wang to TRSDOS and vice versa.

*Julio E. Sosa
P.O. Box 6-473
Panama City
Republic of Panama*

A Call from Nature

I'm a teacher at a natural resource college, and I'd like to hear from others on how they use their TRS-80s in the natural resource fields. Also, I'd like to know how to get double-width characters in Assembly language.

*Robert Johnson
274 Grey St.
Brantford, Ontario N3S 4W8
Canada*

Footnotes¹

I'm looking for a Model I footnote program integrated with Scripsit that features pagination, formatting, and numbering. Can anyone help me?

Also, has anyone figured out how to save either a Basic or ASCII file onto tape from the Atari 400 and then read that tape into a Model I?

*E. Judson Jennings
299 Ridgewood Ave.
Glen Ridge, NJ 07028*

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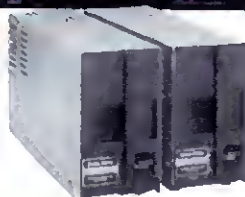
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Now You Can Talk

There is an error in Program Listing 5 of Douglas Payne's article, "Talk to the Big Guys" (September 1983, p. 230). In the program UT5, lines 1490, 1510, 1580, 1630, 1650, 1700, 1720 have been incorrectly printed as DEFB ''. You must change them to read DEFB '27H' for the program to work correctly.—Eds.

Blackjack

The last part of line 1230 and all of line 1240 is missing in Program Listing 4 of my "Model II Casino" article (August 1983, p. 148). These lines should read:



Flaws and fixes

```
1230 PRINTCHR$(2);:PRINT@L," "
:PRINT@L+80," "':PRINT@L+160," "
:PRINTCHR$(1);:RETURN
1240 PRINTCHR$(2);:L=683:GOSUB1230
:RX=R6:GOSUB1160:TS=MS(R6)
:GOSUB1200:PRINTCHR$(1);:RETURN
```

```
IRAND: PUSH HL
CALL RANDOM ;reinitialize random numbers
POP HL
LD A,(HL) ;and so on
```

Figure 1. Calling Random.

Also, in the "Black Friday" conversion program (Take 11, July 1983, p. 342), the last equals sign in line 510 should be an asterisk.

Byron Lott
913 Inverness Way
Sunnyvale, CA 94087

A Random Breakout?

There is a minor problem with J.B. Harrell's "Fortran Breakout" article (July 1983, p. 186). The IRAND function in USRLIB/MAC isn't very random after the first two or three calls (to be sure, I checked the routine with TASMOM). It does have an easy fix, however. Just call RANDOM every time (see Fig. 1).

In addition, three bytes can be saved for each of the one-command calls (CLS, RANDOM, GETCH) by simply setting the entry equal to the address (ex. CLS EQU 01C9H).

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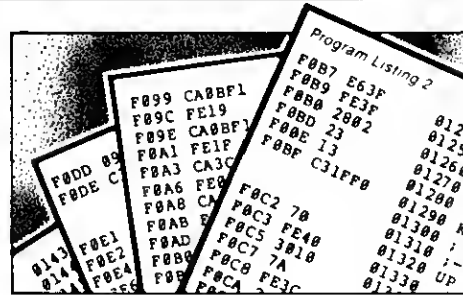
"... ongoing support second to none, with superb documentation." (80 U.S. Journal, Feb. 1982)



Last month, I explained a simple utility that displayed all current variables in a running Basic program. This month, as promised, I'll explain how to add a new feature to that utility: the ability to display the current value of any current variable.

After the program displays each screen of active variables, you'll be able to either press the enter key to go on to the next page or type in a variable name. If you enter a variable name, its value appears on the screen until you press a key; then you again face the choice of pressing the enter key or typing in another variable name.

Much of Program Listing 1 is identical to last month's program. Realizing you probably won't want to type in the same program again, I've marked all new or modified lines with an asterisk at the beginning of the comment column. Some line numbers have changed, but if a program block doesn't have any marked lines, you won't need to change anything in the source code. You will, however, have to delete lines 2550 and



Displaying the values of variables

2610-2670 from last month's program. After you've added the new lines, type N100,10 and be sure you end up with the same last line as the listing.

The first major change in the program, aside from some new EQU statements and a new ORG address, occurs in lines 960-1040, where I've added a

flag-handling routine. This program uses ROM routines to read and decipher the keyboard. However, the entire program starts with decoding a special combination of three keys: the shift, down-arrow, and V keys. If the utility is active (displaying variables) and the operator again pushes the control/V key combination, the program doubles back on itself recursively. The screen and cursor buffers are overwritten, and the program ends up in an endless loop.

To avoid such problems, line 970 reads a flag that shows whether the utility program is currently running. If the program sets the 1-byte flag to zero, it ignores control/V and invokes the regular keyboard driver. If the utility program sets the flag to any other value (generally OFF hexadecimal (hex)) it knows that it's not currently running and lets itself be invoked. The utility sets the flag to zero when you enter the program and resets to OFF hex during the Done routine as the program returns control to Basic.

The flag avoids the problems that recursion would create, but it can cause another problem: Some ROM routines that the program calls generate an error condition. If an error occurs, the ROM routine reports the error on the screen and returns control to Basic's READY prompt, bypassing the normal flag reset in Done. The flag remains set at zero and you won't be able to use the utility because it reacts as if it's already being used. To reactivate the program, you have to POKE any non-zero value into the flag's location (0BFFF hex if you don't change the ORG value).

The second addition to the program is the routine called NOKEY. I found that I occasionally fail to release the control/V key sequence quickly enough, so one of the keys is read as part of the variable name. The NOKEY routine guards against this by refusing to let the program start until you've released all the keys. The B register is used as a counter to help delay the NOKEY reading to avoid keybounce. If you still have a problem with spurious key reads, increase the time of the loop by using BC as a counter.

The ENDSCR routine is almost entirely new and contains the crux of this

Address	Description								
RST 18 hex	Compares the values in the DE and HL register pairs. Sets flags to show results: <table> <tr> <td>Carry</td><td>HL<DE</td></tr> <tr> <td>No Carry</td><td>HL>=DE</td></tr> <tr> <td>Zero</td><td>HL=DE</td></tr> <tr> <td>Not Zero</td><td>HL<>DE</td></tr> </table>	Carry	HL<DE	No Carry	HL>=DE	Zero	HL=DE	Not Zero	HL<>DE
Carry	HL<DE								
No Carry	HL>=DE								
Zero	HL=DE								
Not Zero	HL<>DE								
0049 hex	Waits for single keyboard input—returns ASCII value of input key in A register. Uses AF and DE registers.								
01C9 hex	Clears screen, resets cursor to top of screen, sets 64-character mode, and turns off cassette port (Basic's CLS routine).								
033A hex	Displays character in A on screen at next print position. Uses AF.								
05D9 hex	Inputs line from keyboard. On entry, HL points to buffer to hold input, B holds maximum number of characters to input. You terminate input by pressing the enter or break key. On output, HL points to start of text, B equals actual input length (except terminator), C holds original value of B, A holds ASCII value of terminating character, C flag is set only if input is terminated with the break key.								
0A9A hex	Current value in HL is loaded into Basic's workspace/accumulator, and the variable type flag is set to 02 (integer).								
0ACC hex	Value in workspace/accumulator changed from integer to single precision.								
0FDB hex	Converts value in work workspace/accumulator into display form, and returns address of resulting string in HL.								
2540 hex	Loads value of variable into workspace/accumulator. On entry, HL points to first character of variable name. On exit, HL points to first character following variable name.								
2B75 hex	Output a string to current output device. On entry, HL points to first character of string, which must end with a zero byte.								

Figure. ROM routines used in the variable display programs.

month's modification. After correctly positioning the print cursor, the program prints a CHR\$(IF hex) on the screen. That control character clears the screen from the present print position to the end of the screen. This is necessary to erase any characters left from a previous variable and value display.

Then, after the program displays the prompt message, line 2830 points HL at an input buffer and sets B to the buffer's length in preparation for accepting a typed-in variable name. Since both DOS and Basic have input buffers, you may wonder why they weren't used instead of dedicating space to a third buffer. I didn't use the DOS buffer because there is no guarantee it will be in the same position with different DOS systems, or with different versions of the same DOS. I left the Basic buffer alone because you might want to call up the variable display while writing or editing a line of Basic and not wish to return to a line filled with garbage.

After you set up HL and B, the program calls the ROM routine LINEIN. This routine accepts keyboard input of a string up to the maximum length set in register B. With each keystroke, the character appears on the screen and is stored in the buffer to which HL points. The routine reacts normally to backspacing and other control characters. On return, the B register contains the number of characters actually entered except for the terminating character (enter or break). If you press the break key, the program sets the carry flag.

If you press the break key during variable input and set the carry flag, the program loops back to the prompt and again awaits operator input. If B equals zero, you pressed the enter key without any additional characters, so the screen clears and control returns to the display routines.

If you input any additional characters, the program assumes it has a variable name in the buffer. First, the program establishes a new cursor position. Then it prints the variable name followed by an equal sign. The program points HL at the variable name again and calls the ROM routine VALACU.

VALACU (2540 hex) is a complex routine that takes the variable name at which HL points, evaluates that variable, transfers its value to the low memory accumulator, and sets a flag to indicate the variable type (integer, string,

Program Listing 1. Current variable display.

```

00100 ;*****
00110 ;*
00120 ;*   Current Variable Display   *
00130 ;*
00140 ;*   On <Shift> <Dwn-arrow> <V> *
00150 ;*   shows two screens (or more)*
00160 ;*   1st -- all defined, simple *
00170 ;*       variables                *
00180 ;*   2nd -- all defined array   *
00190 ;*       variables                *
00200 ;*
00210 ;*   After each screen, values  *
00220 ;*   of current variables may  *
00230 ;*   be listed.                 *
00240 ;*
00250 ;*****
00260 ;
00270 ;
00280 ;Listing of routines and addresses:
00290 ;
033A 00300 PRINT1 EQU 033AH ;PRINT 1 CHAR.
2B75 00310 PRINT EQU 2B75H ;PRINT STRING
01C9 00320 CLS EQU 01C9H ;CLEAR SCREEN
0A9A 00330 HLACUM EQU 0A9AH ;HL==> RAM ACCUMULATOR
0ACC 00340 ACINSN EQU 0ACCH ;ACCU. VALUE INT=>SINGLE
0FBD 00350 ACUSTR EQU 0FBDH ;ACCU => ASCII STRING
05D9 00360 LINEIN EQU 05D9H ;*ROM LINE INPUT ROUTINE
2540 00370 VALACU EQU 2540H ;*VALUE OF VAR.=> ACCUM
40AF 00380 VTFLAG EQU 40AFH ;*VARIABLE TYPE MARKER
0049 00390 WAITKY EQU 0049H ;*GET SINGLE KB INPUT
00400 ;
4016 00410 KBDVR EQU 4016H ;KB DRIVER ADDRESS
4020 00420 CURSAD EQU 4020H ;CURSOR POSITION ADDRESS
00430 ;
3804 00440 ROW3 EQU 3804H ;P-W KEYBOARD ROW
3840 00450 ROW7 EQU 3840H ;ENT & ARROWS KB ROW
3880 00460 ROW8 EQU 3880H ;SHIFT KEYBOARD ROW
00470 ;
3C00 00480 VIDEO EQU 3C00H ;TOP OF SCREEN
3F7B 00490 ENDDSP EQU 3F7BH ;LAST LINE FOR DISPLAY
3F88 00500 PRTPOS EQU 3F88H ;ADDR. FOR PROMPT DISPLAY
00510 ;
4411 00520 MEMTOP EQU 4411H ;MENTOP FOR MOD.III DISK
00530 ; use 4049H for MODI Disk, 40B1H for tape systems
00540 ;
40F9 00550 SVT EQU 40F9H ;BEG. OF VARIABLE LIST
40FB 00560 AVT EQU 40FBH ;BEG. OF ARRAY LIST
40FD 00570 FREE EQU 40FDH ;BEG. OF FREE SPACE
00580 ;
00590 ;
00600 ; First, patch routine into keyboard
00610 ; driver, being careful to save current
00620 ; driver address, and reset MEMTOP.
00630 ;
B9C5 00640 ORG 0B9C5H ;CHANGE ORG TO RELOCATE
00650 ; this address for top of 32K RAM
00660 ;
B9C5 2A1640 00670 SETUP LD HL,(KBDVR) ;GET CURRENT DRIVER ADDR.
B9C8 11DDE9 00680 LD DE,TEST ;GET ROUTINE ADDR.
B9CB DF 00690 RST 18H ;COMPARE DE & HL
B9CC 280C 00700 JR Z,SET10 ;GO IF ALREADY SET
B9CE 22F0B9 00710 LD (RETURN+1),HL ;SET RETURN ADDR.
B9D1 ED531640 00720 LD (KBDVR),DE ;SET 'TEST' AS KB DRIVER
B9D5 1B 00730 DEC DE ;DE=TEST-1
B9D6 ED531144 00740 LD (MEMTOP),DE ;SET MEMTOP
B9DA C32D40 00750 SET10 JP 402DH ;RETURN TO DOS
00760 ;
00770 ; Line 750 should be JP 1A19H for tape systems
00780 ;
00790 ; Now test for <SHIFT> <DOWN-ARROW> <V>
00800 ;
B9DD 3A4038 00810 TEST LD A,(ROW7) ;GET DWN-ARW ROW
B9E0 E610 00820 AND 10H ;IS IT DWN-ARW?
B9E2 280B 00830 JR Z,RETURN ;GO IF NOT
B9E4 3A0038 00840 LD A,(ROW8) ;GET SHIFT ROW
B9E7 B7 00850 OR A ;SET FLAGS
B9E8 2805 00860 JR Z,RETURN ;GO IF NO SHIFT KEY
B9EA 3A0438 00870 LD A,(ROW3) ;GET P-W ROW
B9ED E640 00880 AND 40H ;CHECK FOR V
B9EF CA0000 00890 RETURN JP Z,0000H ;SETUP PUTS VALUE HERE
00900 ;
00910 ; <Shift> <down-arrow> <V> have been pressed.
00920 ; Check flag status.
00930 ; Save all registers.
00940 ; Save screen & then clear it.
00950 ;
B9F2 CD25BB 00960 CALL PUSHAL ;SAVE ALL REGISTERS
B9F5 3AFFBF 00970 LD A,(FLAG) ;*GET FLAG REGISTER
B9F8 B7 00980 OR A ;*SET F REGISTER
B9F9 2806 00990 JR Z,NOTNOW ;*CO IF ZERO
B9FB AF 01000 XOR A ;*SET A TO ZERO
B9FC 32FFBF 01010 LD (FLAG),A ;*SET FLAG REGISTER
B9FF 1805 01020 JR NOKEY ;*AND GO
01030 ;
BA01 CD2EBB 01040 NOTNOW CALL POPAL ;*RESTORE REGISTERS
BA04 18E9 01050 JR RETURN ;*GO TO NORMAL KB DRIVER
01060 ;
BA06 06FF 01070 NOKEY LD B,255 ;*SET FOR TIMING LOOP

```

Listing 1 continued

Listing 1 continued

```

BA08 3AFF3B 01080 NOKEYS LD A,(3BFFH) ;*CHECK FOR ANY KEY
BA0B B7 01090 OR A ;*SET FLAGS
BA0C 20FA 01100 JR NZ,NOKEYS ;*LOOP UNTIL ALL KEYS UP
BA0E 10F8 01110 DJNZ NOKEYS ;*LOOP FOR KEY BOUNCE
;
BA10 11FDBB 01130 SAVE LD DE,SCRBUF ;DE==> SCREEN BUFFER
BA13 21883C 01140 LD HL,VIDEO ;HL==> SCREEN
BA16 0100C4 01150 LD BC,400H ;BC = SCREEN LENGTH
BA19 EDB0 01160 LDIR ;MOVE SCREEN
BA1B 2A2040 01170 LD HL,(CURSAD) ;GET CURRENT CURSOR ADDR.
BA1E 22FDBF 01180 LD (CRSBUF),HL ;AND SAVE IT ALSO
BA21 CDC901 01190 CALL CLS ;CLEAR THE SCREEN
BA24 21883F 01200 LD HL,PRTPOS ;GET PRINT POSITION
BA27 222040 01210 LD (CURSAD),HL ;MOVE CURSOR AWAY
;
01220 ;
01230 ; Now get list of simple (not array) variables and print
01240 ; each on the screen.
01250 ;
;
BA2A DD2AF940 01260 LD IX,(SVT) ;IX==>VARIABLE LIST
BA2E 21803C 01270 LD HL,VIDEO ;HL==> SCREEN
BA31 FD21E2BB 01280 LD IY,TYPES ;IY==> VAR. TYPE TABLE
BA35 E5 01290 VAR10 PUSH HL ;SAVE SCREEN PTR.
BA36 DDE5 01300 PUSH IX ;MOVE VAR. LIST PTR
BA38 E1 01310 POP HL ; TO HL
BA39 ED5BFB40 01320 LD DE,(AVT) ;GET END OF VAR. TABLE
BA3D DF 01330 RST 18H ;CP HL:DE
BA3E E1 01340 POP HL ;RECOVER SCREEN PTR.
BA3F 303E 01350 JR NC,ARRAY ;GO IF NO MORE VARIABLES
;
01360 ;
BA41 DD4600 01370 LD B,(IX) ;GET VARIABLE TYPE
BA44 DD7E02 01380 LD A,(IX+2) ;1ST LETTER OF VAR. NAME
BA47 77 01390 LD (HL),A ;PRINT IT
BA48 23 01400 INC HL ;BUMP POINTER
BA49 DD7E01 01410 LD A,(IX+1) ;2ND LETTER OF VAR. NAME
BA4C B7 01420 OR A ;SET FLAGS
BA4D 2802 01430 JR Z,VAR20 ;GO IF ZERO
BA4F 77 01440 LD (HL),A ;ELSE PRINT IT
BA50 23 01450 INC HL ;AND BUMP POINTER
BA51 78 01460 VAR20 LD A,B ;GET VARIABLE TYPE
BA52 3D 01470 DEC A ;DECREASE BY TWO TO
BA53 3D 01480 DEC A ; ALIGN WITH TABLE
BA54 3259BA 01490 LD (IYPTR+2),A ;USE FOR OFFSET
BA57 FD7E00 01500 IYPTR LD A,(IY+0) ;GET TYPE SYMBOL
BA5A 77 01510 LD (HL),A ;PUT ON SCREEN
BA5B 23 01520 INC HL ;BUMP POINTER
BA5C 23 01530 INC HL ;AND AGAIN FOR SPACE
;
01540 ;
BA5D DD23 01550 INC IX ;GET PAST HEADER
BA5F DD23 01560 INC IX ; WITH THREE
BA61 DD23 01570 INC IX ; INCREMENTS
BA63 DD23 01580 VAR30 INC IX ;MOVE PAST VAR. INFO
BA65 10FC 01590 DJNZ VAR30 ;DEPENDENT ON VAR. TYPE
;
01600 ;
01610 ;Check screen
BA67 117B3F 01620 LD DE,ENDDSP ;LAST PRINT POS.
BA6A DF 01630 RST 18H ;CP HL:DE
BA6B D437BB 01640 CALL NC,ENDSCR ;GO IF SCREEN FULL
BA6E 7D 01650 LD A,L ;GET LSB OF SCREEN PTR.
BA6F E63F 01660 AND 3FH ;MASK BITS 6 & 7
BA71 FE3C 01670 CP 3CH ;END OF LINE?
BA73 38C0 01680 JR C,VAR10 ;RETURN IF NOT
BA75 114000 01690 LD DE,40H ;LINE OFFSET
BA78 19 01700 ADD HL,DE ;HL==> NEXT LINE
BA79 7D 01710 LD A,L ;GET LSB
BA7A E6C0 01720 AND 0C0H ;MASK OUT BITS 0-5
BA7C 6F 01730 LD L,A ;HL==> START OF NEXT LINE
BA7D 18B6 01740 JR VAR10 ;GET ANOTHER VARIABLE
;
01750 ;
01760 ;show show arrays
01770 ;
;
BA7F CD37BB 01780 ARRAY CALL ENDSCR ;NEW SCREEN FOR ARRAYS
BA82 DD2AFB40 01790 LD IX,(AVT) ;IX==>ARRAY TADLE
BA86 DDE5 01800 ARR10 PUSH IX ;TRANSFER PTR TO
BA88 E1 01810 POP HL ; TO HL
BA89 ED5BFD40 01820 LD DE,(FREE) ;DE==>END OF ARRAYS
BA8D DF 01830 RST 18H ;CP HL:DE
BA8E 3075 01840 JR NC,DONE ;GO IF END OF TABLE
;
01850 ;
BA90 DD4600 01860 LD B,(IX+0) ;GET VARIABLE TYPE
BA93 DD7E02 01870 LD A,(IX+2) ;1ST LETTER OF VAR. NAME
BA96 CD3A03 01880 CALL PRINT1 ;PRINT A
BA99 DD7E01 01890 LD A,(IX+1) ;2ND LETTER OF VAR. NAME
BA9C B7 01900 OR A ;SET FLAGS
BA9D 2803 01910 JR Z,ARR20 ;GO IF 0
BA9F CD3A03 01920 CALL PRINT1 ;ELSE PRINT IT
BAA2 78 01930 ARR20 LD A,B ;GET VAR. TYPE VALUE
BAA3 3D 01940 DEC A ;SUBTRACT TWO TO
BAA4 3D 01950 DEC A ; ALIGN WITH TABLE
BAA5 32AABA 01960 LD (IYPTR2+2),A ;ADDRESS TABLE
BAA8 FD7E00 01970 IYPTR2 LD A,(IY+0) ;GET TYPE SYMBOL
BAAB CD3A03 01980 CALL PRINT1 ;AND PRINT IT
BAAE 3E28 01990 LD A,'(' ;PAREN, CHAR.
BAB0 CD3A03 02000 CALL PRINT1 ;AND PRINT IT
;
02010 ;
BAB3 DD4E05 02020 LD C,(IX+5) ;GET # OF DIMENSIONS
BAB6 DD5E03 02030 LD E,(IX+3) ;DE WILL HAVE OFFSET
BAB9 DD5604 02040 LD D,(IX+4) ; TO NEXT ARRAY
BABC DDE5 02050 PUSH IX ;TRANSFER IX VALUE TO
BABE E1 02060 POP HL ; HL REGISTER
BABF 19 02070 ADD HL,DE ;ADD OFFSET

```

Listing 1 continued

single precision, or double precision). If the variable is a string, its VARPTR address is loaded into the accumulator instead of its value.

Next, the program checks the variable type flag. If the type flag equals 3, the variable is a string, and control passes to STRDSP in line 3140. Otherwise, the ROM routine ACUSTR, which I described last month, changes the variable's value into an ASCII string and the program prints that string. Then the ROM routine WAITKY (0049 hex), which waits for any keyboard input, is used to freeze the display until you press any key before the program loops back to END10. WAITKY takes the place of last month's GETENT, which is no longer included in the program.

If the variable is a string, IX points to its VARPTR address (line 3210). Then the program loads B with the string's length and HL with its location in memory. Because the string is not terminated with a 00 hex byte, you cannot use the normal Print routine. Instead, the program calls the PRTSTR routine at line 3280 to print the string.

PRTSTR first checks the string's length. If it is zero, control returns immediately without any further processing. Otherwise, the program prints the string with a DJNZ loop until B is decremented to zero.

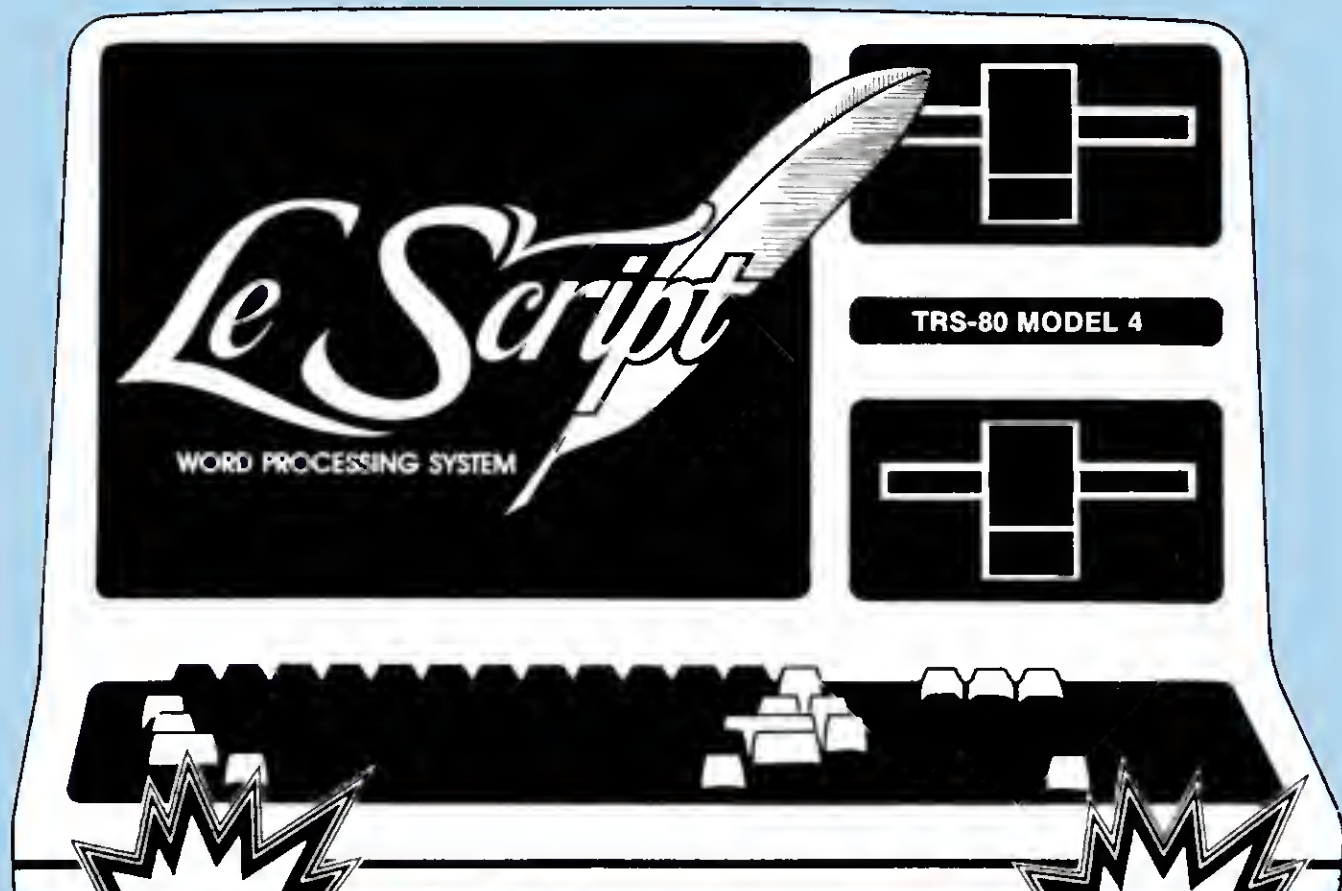
For quick reference, the Figure summarizes the ROM routines and low-memory pointers used by this month's and last month's programs. Before you add the ROM routines to your own programs, you must exercise caution. Some ROM routines (2B75 hex is a notorious example) only work properly if Basic is initialized. If you use a tape system, you never have to worry because Basic is initialized automatically when you turn on the power.

However, if you use a disk system, you can use programs with ROM routines only if you've loaded Disk Basic since you turned on the computer. If you find a program, particularly a magazine program, that doesn't work as it should, try going to Disk Basic, returning to DOS, and rerunning it.

The problem is that ROM Basic was written to be expanded in two ways. Each expansion necessitates an exit from ROM to a patch point in low memory. The first type of expansion is the addition of Disk Basic command verbs (CMD", INSTR, OPEN, DEF,

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Listing 1 continued

BAC0 110500	02000	LD	DE,5	;OFFSET FOR HEADER
BAC3 19	02090	ADD	HL,DE	;HL==> NEXT ARRAY
BAC4 E5	02100	PUSH	HL	;SAVE ADDRESS
	02110 ;			
BAC5 0606	02120	LD	B,6	;BUMP IX 6 TIMES
BAC7 DD23	02130	INC	IX	; SO IX==> SIZE OF
BAC9 10FC	02140	DJNZ	ARR30	; 1ST DIMENSION
	02150 ;			
BACB 41	02160	LD	B,C	;GET # OF DIM.
BACC CB20	02170	SLA	B	;MULTIPLY BY TWO
BACE DD23	02180	JNC	IX	;BUMP POINTER
BAD0 10FC	02190	DJNZ	ARR40	;UNTIL PAST DIM SIZES
	02200 ;			
BAD2 41	02210	LD	B,C	;GET # OF DIM. AGAIN
BAD3 DD2B	02220	DEC	IX	;DROP IX UNTIL IT
BAD5 DD2B	02230	DEC	IX	; POINTS TO NEXT DIM.
BAD7 DD6E00	02240	LD	L,{IX+0}	;GET LSB OF DIM SIZE
BADA DD6E01	02250	LD	H,{IX+1}	; AND MSB
BADD 2B	02260	DEC	HL	;CORRECT FOR 0 ELEMENT
BADE CDB2BB	02270	CALL	ASCPRT	;PRINT AS ASCII
	02280 ;			
BAE1 3E2C	02290	LD	A,',	;GET COMMA CHAR.
BAE3 CD3A03	02300	CALL	PRINT1	;AND PRINT IT
BAE6 10EB	02310	DJNZ	ARR50	;REPEAT FOR ALL DIM.S
	02320 ;			
BAE8 212B40	02330	LD	HL,CURSAD	;HL==>CURSOR POS'N
BAEB 35	02340	DEC	(HL)	;MOVE BACK OVER LAST ",
BAEC 3E29	02350	LD	A,',	;GET CLOSE PAREN.
BAEE CD3A03	02360	CALL	PRINT1	;AND PRINT IT
BAF1 3E20	02370	LD	A,' '	;NOW AN ASCII SPACE
BAF3 CD3A03	02380	CALL	PRINT1	;AND PRINT IT
BAF6 2A2040	02390	LD	HL,(CURSAD)	;GET CURSOR POS'N
BAF9 117B3F	02400	LD	DE,ENDDSP	;END OF PRINT AREA
BAFC DF	02410	RST	10H	;CP HL:DE
BAFD D437BB	02420	CALL	NC,ENDSCR	;GO IF SCREEN FULL
	02430 ;			
BB00 DDE1	02440	POP	IX	;IX==> NEXT ARRAY
BB02 C306BA	02450	JP	ARR10	;GO TO WORK ON IT
	02460 ;			
BB05 CD37BB	02470	CALL	ENDSCR	;ASK FOR ENTER
BB08 21PDBB	02480	LD	HL,SCRBUF	;HL==>SCREEN BUFFER
BB0B 11003C	02490	LD	DE,VIDEO	;DE==>SCREEN
BB0E 010004	02500	LD	BC,400H	;BC = SCREEN LENGTH
BB11 ED00	02510	LDIR		;MOVE TO SCREEN
BB13 2AFDBF	02520	LD	HL,(CRSBUF)	;GET OLD CURS. POS'N
BB16 222040	02530	LD	(CURSAD),HL	;AND RESTORE IT
BB19 3EFF	02540	LD	A,0FFH	;VALUE FOR RECUR. FLAG
BB1B 32FFBF	02550	LD	(FLAG),A	;RESET RECURS. FLAG
BB1E CD2EBB	02560	CALL	POPAL	;RESTORE REGISTERS
BB21 AF	02570	XOR	A	;A & Z-FLAG SHOW 0
BB22 C3EPB9	02580	JP	RETURN	;RETURN TO BASIC
	02590 ;			
BB25 E3	02600	PUSHAL	(SP),HL	;HL ON STACK; SAVE RET
BB26 C5	02610	PUSH	BC	;SAVE ALL REGS
BB27 05	02620	PUSH	DE	
BB28 DDE5	02630	PUSH	IX	
BB2A FDE5	02640	PUSH	IY	
BB2C E5	02650	PUSH	HL	
BB2D C9	02660	RET		;ORIG. RET ADDR. TO STACK
	02670 ;			
BB2E E1	02680	POPAL	POP	HL
BB2F FDE1	02690	POP	IY	;GET RET. ADDR.
BB31 DDE1	02700	POP	IX	;RESTORE ALL REGS.
BB33 D1	02710	POP	DE	
BB34 C1	02720	POP	BC	
BB35 E3	02730	EX	(SP),HL	;GET ORIG. HL
BB36 C9	02740	RET		
	02750 ;			
BB37 CD25BB	02760	CALL	PUSHAL	;SAVE REGISTERS
BB3A 218B3F	02770	LD	HL,PRTPOS	;HL==>PRINT POSITION
BB3D 222040	02780	LD	(CURSAD),HL	;SET CURSOR ADDRESS
BB40 3E1F	02790	LD	A,1FH	;IF=CLEAR TO END OF FRAME
BB42 CD3A03	02800	CALL	PRINT1	;PRINT IT
BB45 21C6BB	02810	LD	HL,MSG	;HL==>PROMPT MESSAGE
BB48 CD752B	02820	CALL	PRINT	;PRINT IT
BB4B 21E9BB	02830	LD	HL,VARBUF	;HL==>INPUT BUFFER
BB4E 0614	02840	LD	B,20D	;B=MAX. INPUT LENGTH
BB50 CDD905	02850	CALL	LINEIN	;GET KEYBOARD INPUT
	02860 ;			
BB53 38E5	02870	JR	C,END10	;GO IF <BREAK> HIT
BB55 78	02880	LD	A,B	;GET INPUT LENGTH
BB56 B7	02890	OR	A	;SET FLAGS
BB57 200A	02900	JR	NZ,END20	;GO IF VARIABLE REQUESTED
BB59 CDC901	02910	CALL	CLS	;ELSE CLEAR SCREEN
BB5C CD2EBB	02920	CALL	POPAL	;RESTORE REGISTERS
BB5F 21003C	02930	LD	HL,VIDEO	;HL==>SCREEN TOP
BB62 C9	02940	RET		;AND RETURN
	02950 ;			
BB63 C5	02960	END20	PUSH	;SAVE VARIABLE LENGTH
BB64 0608	02970	LD	B,0	;FOR 0 SPACES
BB66 3E20	02980	LD	A,' '	;A=ASCII SPACE
BB68 CD3A03	02990	CALL	PRINT1	;PRINT
BB6B 10FB	03000	DJNZ	END30	; 8 SPACES
BB6D C1	03010	POP	BC	;RECOVER LENGTH COUNT
BB6E 21E9BB	03020	LD	HL,VARBUF	;HL==>BEGINNING OF VAR.
BB71 E5	03030	PUSH	HL	;AND SAVE IT
BB72 CDA7BB	03040	CALL	PRTSTR	;PRINT VAR NAME AS STRING
BB75 3E20	03050	LD	A,' '	;A=ASCII SPACE
BB77 CD3A03	03060	CALL	PRINT1	;AND PRINT IT
BB7A 3E3D	03070	LD	A,'='	;A= EQUAL SIGN

Listing 1 continued

LOAD, and so on). The execution address for each of these new verbs already exists in ROM, but the operation code does not—DOS must supply it. When you boot up a tape system, each Disk Basic command patch point is filled with the L3 error's address.

The second type of patch point to DOS is completely different. Several ROM routines, including many of the output routines, include a call to a low-memory address. When you use a tape system, a return instruction (0C9 hex) is loaded into each of those addresses; when you load Disk Basic, either a return, or a jump to a special Disk Basic routine is loaded into each address. However, when you first boot up DOS, no values are specifically loaded to those patch points and any program that calls them will probably find itself wandering off into oblivion.

The purpose of the second set of patch points is to let DOS writers add new, more powerful features to Basic. But if you are writing Assembly-language programs meant to be compatible with disk systems and run under DOS, and you want to use ROM routines, you should close any patch points your program might come across with a 0C9 hex byte before the ROM routines are called. The patch points are at addresses 41AC hex, 41AF hex, 41B2 hex, and so on up to 41E2 hex, on both the Models I and III.

Defining Variables

Besides showing the current active variables, this month's program can help you improve your Basic programming. Your programs store all simple variables in memory below all array variables. If your program uses arrays, they have to be moved every time you define or use a new simple variable. If one of your first program lines dimensions all arrays, it will slow down your program considerably by the pauses necessary to shift the arrays up in memory whenever you use a new simple variable. Your program will run faster if you define all simple variables before you dimension arrays.

There are two ways to define simple variables at the beginning of the program. The first, and more structured, is to give each a pre-set value (such as A=0, B=2, and C=.479). However, if you're going to set many of the variables to zero, or if the program will set

them as it uses them, you can define simple variables the same way you define arrays: with the DIM command. DIM A,B,C defines, and sets up space for, the three variables listed.

Therefore, a sensible order of commands at the beginning of a program would be:

- Clear sufficient string space;
- Define or Dimension simple variables;
- Dimension array variables.

The second lesson to be gained from variables displays is that the order of variables in memory makes a difference. Whenever Basic has to deal with any variable, it searches the appropriate table from the beginning. If it finds the variable, it continues to process the current command. If it can't find the variable, it (usually) must make room for it and add it to the table.

If your most frequently used variables are at the bottom of the table, they will be found faster and your program will run more quickly. To place them at the bottom of the table, be sure to define them first.

One interesting side note—if you ask Basic for the value of a simple variable that you have not previously defined, it searches the SVT and, failing to find the variable, answers zero for a numeric variable or "" for a string variable. However, it will *not* add the variable to the SVT.

If you ask Basic for the value of an element in an array that you haven't previously defined, Basic first creates the array in the AVT, using the default value of 10 for the maximum of each index, and then reports that the value of the array element is zero or "". Be careful when you use arrays; they can fill up memory quickly. The innocuous looking statement:

```
DIM A$(7,8,8,8)
```

requires 46,666 bytes, and uses up almost all available memory in a 48K tape-based Model III.

Random Numbers

In my own programming and in questions from readers, the subject of random numbers has come up several times. There seems to be a misunderstanding about what a random number is and how random numbers are generated internally in Basic.

Listing 1 continued

```

BB7C CD3A03 03080 CALL PRINT1 ;*AND PRINT THAT
BB7F E1 03090 POP HL ;*HL=>VARIABLE AGAIN
BB80 CD4025 03100 CALL VALACU ;*VARIABLE'S VALUE=>ACCUM.

BB83 3AAF40 03120 LD A,(VTFLAG) ;*GET VARIABLE TYPE MARKER
BB86 FE03 03130 CP 3 ;*IS IT A STRING?
BB88 2008 03140 JR Z,STRDSP ;*GO TO STRING ROUTINE

BB8A CD0D0F 03160 CALL ACUSTR ;*TURN VALUE INTO STRING
BB8D CD7520 03170 CALL PRINT ;*AND PRINT IT
BB90 CD4900 03180 END40 CALL WAITKY ;*WAIT FOR KEYSTROKE
BB93 10A5 03190 JR END10 ;*AND REPEAT

BB95 DD2A2141 03210 STRDSP LD IX,(4121H) ;*IX = STRING'S VARPTR
BB99 DD4600 03220 LD B,(IX+0) ;*B=STRING LENGTH
BB9C DD6E01 03230 LD L,(IX+1) ;*NSB OF ADDR.
BB9F DD6E02 03240 LD H,(IX+2) ;*HL=>STRING
BBA2 CDA7BB 03250 CALL PRTSTR ;*PRINT THE STRING
BBA5 10E9 03260 JR END40 ;*AND GO

BBA7 70 03270 ;
BBA8 B7 03280 PRTSTR LD A,B ;*GET STRING LENGTH
BBA9 C8 03290 OR A ;*SET FLAGS
BBAF 7E 03300 RET Z ;*RETURN IF NO LENGTH
BBAB CD3A03 03310 PRT10 LD A,(HL) ;*GET CHARACTER
BBAE 23 03320 CALL PRINT1 ;*AND PRINT IT
BBAF 10F9 03330 INC HL ;*BUMP POINTER
BBB1 C9 03340 DJNZ PRT10 ;*LOOP UNTIL DONE
03350 RET ;*RETURN TO CALLER
03360 ;
03370 ;
BBB2 03380 ASCPRT EQU S ;PRINT HL VAL ON SCREEN
BBB3 EB 03390 EX DE,HL ;SAVE HL REG.
BBB6 CD25BB 03400 CALL PUSHAL ;SAVE REGS.
BBB8 EB 03410 EX DE,HL ;RECOVER ORIG HL VALUE
BBB7 CD9A0A 03420 CALL HLACUH ;HL=> ACCUMULATOR
BBBA CDBCC0A 03430 CALL ACINSN ;ACCUM INT=> SINGLE PREC.
BBBD CDB00F 03440 CALL ACUSTR ;MAKE ACCUM INTO STRING
BBC0 23 03450 INC HL ;SKIP LEADING SPACE
BBC1 CD7520 03460 CALL PRINT ;PRINT VALUE
BBC4 CD2EBB 03470 CALL POPAL ;RESTORE REGS.
BBC7 C9 03480 RET
03490 ;
03500 ;
03510 ; Now table, message, & buffers
03520 ;
BBC8 56 03530 MSG DEFH 'Variable Name or <ENTER> ' ;*
BBE1 00 03540 DEFB 00H ;END OF MSG MARKER
03550 ;
BBE2 25 03560 TYPES DEFB 'A' ;LIST OF VARIABLE TYPE
BBE3 24 03570 DEFB 'S' ; MARKERS
BBE4 21 03580 DEFB '!'
BBE5 0000 03590 DEFW 00H ;PAD WITH 3 SPACES
BBE7 00 03600 DEFB 00H
BBE8 23 03610 DEFB '0'
03620 ;
0014 03630 VARBUF DEFS 20D ;*BUFFER FOR VAR. NAME
03640 ;
0400 03650 SCRBUF DEFS 400H ;*BUFFER FOR SCREEN
03660 ;
E002 03670 CRSBUP DEFS 2H ;*BUFFER FOR CURSOR POSN
03680 ;
BFFF FF 03690 FLAG DEFB 0FFH ;*RECURSION FLAG
03700 ;
B9C5 03710 END SETUP ;END OF PROGRAM
00000 Total Errors

```

```

LOOP LD A,(3BFFH) ;LOOK FOR KEYSTROKE
OR A ;SET FLAGS
JR Z,LOOP ;LOOP UNTIL STROKE FOUND
LD A,R ;ELSE GET R VALUE
AND 7FH ;MASK OUT BIT 7
;A HAS RANDOM NUMBER

```

Program Listing 2. Trigger routine for reading the R register.

First, generating a random number is simple on a Z80-based machine. The Z80 uses the R register internally to signal memory refresh cycles. During the decoding and execution of every machine-language instruction, Z80 increments the R register, places it on the address bus, and generates a memory

refresh signal. Since this occurs while the Z80 is processing a program instruction, it takes no extra execution time and is generally transparent to the running program.

If, at an unpredictable time, the Z80 reads the R register, its current value is a random number. For the read's time to

be truly unpredictable, some event must trigger it, that, even if repeated frequently, would take much longer than several machine cycles to occur. One such triggering event might be a key pressed by the computer operator.

Try the following experiment to see how the computer generates random numbers. Take a digital watch that has a stopwatch function and can record hundredths of a second. Start the watch, wait a moment, and then press stop. Record the digit in the hundredths column. Now try to repeat the experiment and stop the watch with the same value in the hundredths column. Slow human reflexes combined with the stopwatch button's resistance make the digital stopwatch a reasonable random number generator for numbers between zero and 9 in the hundredth's column. No one could purposely stop the watch with the same digit showing each time.

The Z80 updates the R register much more frequently than the relatively slow hundredths of a second display on a

digital watch. Because bit 7 of the R register never changes (you can set that bit by loading a value into R), reading the R register at random times produces a truly random number between zero and

"The Z80 updates the R register much more frequently than the . . . display on a digital watch."

127. By pressing a key, you can trigger a read, and the code would look something like Program Listing 2.

When you execute the Basic command Random, it also uses the R register, but in a different manner. The entire code for RANDOM is:

```
LD  A,R      ;GET CURRENT R
                VALUE
LD  (40ABH),A ;SAVE IT
RET                    ;END OF ROUTINE
```

The exact instant when Random is executed is certainly unpredictable: It depends on your loading a program that contains the Random command, typing RUN, and pressing the enter key. The only mystery in those three lines of code is why the value is stored in 40AB hex.

The RND function in Basic produces pseudo-random numbers. The values produced seem random, but you could easily predict the next random number if you knew the present state of the computer. Pseudo-random numbers are generated by taking a "seed" value and performing a specific series of arithmetic operations on that value. The new seed value becomes the new pseudo-random number.

The computer stores the random number seed in both the Models I and III at memory locations 40AA hex, 40AB hex, and 40AC hex. The specific algorithm used to generate each successive seed is unimportant here; what is important is that if you know the current seed value and the algorithm, you can accurately predict the next pseudo-random number. In some types of modeling, it's important to be able to use the same set of random numbers repeatedly

in a program to test various hypotheses. To see how such a program might operate, run the following:

```
10 FOR I=1 TO 5
20   POKE 16554,1
30   POKE 16555,2
40   POKE 16556,3
50   FOR J=1 TO 8
60     PRINT RND(100),
70   NEXT J
80   PRINT
90 NEXT I
100 GOTO 100
```

Lines 20, 30, and 40 establish the current seed value, thus determining the series of pseudo-random numbers generated.

It should be clear now how the Random command operates. It takes a truly random value—the current value in R—and uses it to re-seed the pseudo-random number generator. The software pseudo-random number generator always generates the same series of values; the computer uses the Random command to start that series at a random spot on the list. The total list of pseudo-random numbers is long enough that you will probably never have a program that will notice a repetition of values.

If you wish to generate your own pseudo-random numbers in machine language, you'll need to do some research about different pseudo-random algorithms. You will find a great deal of disagreement among the experts about which algorithm is best, and what constitutes a truly random pseudo-random number (if such a beast exists). The ideas are interesting, but the mechanics soon become extremely complex.

Authors' Forum

As I mentioned last month, readers who subscribe to CompuServe may take part in open discussions of topics covered by "The Next Step." GO PCS-117 to the Software and Authors Special Interest Group (SASIG) and leave your questions or comments addressed to me on the message board. Feel free to join in any discussions started by other readers. ■

Write to Hardin Brothers at 280 N. Campus Ave., Upland, CA 91786, or contact him through CompuServe. His e-mail address is 72165,735.

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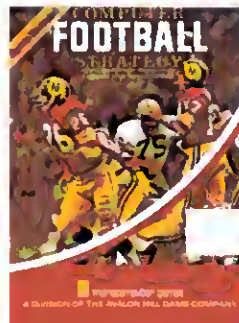
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I've got good news and bad news. The bad news is that this will be the last edition of The Color Key; the good news is that next month, I'll be taking over the Re:FLEX column in *HOT CoCo* and expanding its coverage to include both FLEX and OS-9 software.

While most of the previous action in the area of alternative operating systems centered on FLEX, every indication is that the long-delayed OS-9 software will have a broad range of supporting applications programs for the serious user.

I recently spent an afternoon with Sue and Paul Searby of Computerware, discussing some of their plans for new products. It comes as no surprise that they will market a rather complete line of OS-9 business software, and you can bet that other suppliers will do the same.

Since that's where much of my interest lies, I'm looking forward to working with and writing about the new system. I expect to be in the thick of it by the time you read this column.

And by the way, the fact that Radio Shack is advertising Basic09 for the Color Computer is the best news to come out of Fort Worth in a while. I can hardly wait.

Unfinished Business

Some bugs are subtle and some are just plain dumb, and one of the latter kind has surfaced in my Expgraph program (September 1983, p. 30). Let's see if I can make amends.

You might recall that Expgraph creates a high-resolution graph of expenditures as a function of time for periods of up to a year. The program automatically scales the dollar axis to maximize the resolution of the graph, while restricting the major interval to an integral multiple of \$2, \$5, or \$10 times some power of 10. It also extrapolates the rate at which you spend money, so the user can compare the prediction for year's end with a budget target.

The bug appears in the routine that converts the value used for the expenditure-axis interval to a string in preparation for drawing it on the high-res screen. As I learned when working with one particular set of project cost figures, I should have included code to force this interval to be an integer.

Final words on the CoCo

As things stand, the program is capable of arriving at an interval of, say, \$50000.01. This in turn would appear on the graph, sans decimal point, as a scale factor: \$5000001. Very sloppy, to say nothing of downright wrong.

The solution is simple enough. Change the first half of Expgraph line 1140 from

```
CS=STR$(C)
```

to

```
CS=STR$(INT(C))
```

to enjoy classy displays.

Sorry about that.

What Do You Really Use?

A number of people have written with similar questions: How can I possibly use all the software I review? Why does anyone need 15 data file managers, half a dozen word processors, and three or four spreadsheets? In fact, do I use the stuff at all, or do I give it a quick once-over before consigning it to the wastebasket?

Fair enough. I confess that until I began to get some reader feedback, it never occurred to me that people would think everything I reviewed favorably I'd automatically add to my own collection of everyday tools. I should be flattered, I guess.

Actually, my correspondents are quite right; limits exist to what anyone really needs, and limits to what anyone can

profitably use. It makes little sense to spend all your time learning new command sequences so you can have the latest wrinkle in a particular type of program—unless you need that wrinkle. Therefore, my standard software library changes fairly slowly.

At the same time, I think it's incumbent on me to thoroughly wring out the products I review. I try to spend enough time with each program to explore all its major features.

That takes a fair amount of time, and occasionally it isn't possible to exercise every option of a complex product. Naturally, when reviewing software I only report on the features and commands that I have actually used.

I rely on a fairly standardized set of procedures to test the major types of programs: word processors, file or data-base managers, spreadsheets, and so forth. For example, I test spreadsheets with some dummy research and development (R&D) project budgets, departmental salary plans, and IRS forms. These simulate my principal real-world applications, and give me an opportunity to see how each new review subject handles a typical set of operations.

I often have to depart from my routine to explore novel features of a program, though, and such explorations sometimes convince me to add a product to my stable.

That's how I decided to start using Derringer Software's Pro-Color-File (P.O. Box 5300, Florence, SC 29502) for my heavy-duty data file management. Its particular capabilities for computation and report generation address some of my special needs, so I thought it worth converting many of my files to Pro-Color-File format.

This involves a fair amount of effort, and I certainly wouldn't recommend that everyone start from scratch whenever a new program shows up. My point is that in trying to keep my reviews honest, I have the opportunity to be tempted to buy more software than the typical user. As a result, I probably get involved in more file modification and rewriting than a sane person would tolerate.

I don't always change every file over to accommodate a new product, since I



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SOFTTRENDS

THE COLOR KEY

have some duplication in my working collection.

Now I'll answer the question I raised as the title of this section. Please remember the strong personal component in this business before you write to squawk about my choices. I've favorably reviewed plenty of software that failed to make me switch for my own use.

I have used Telewriter (Cognitec, 704 Nob Ave., Del Mar, CA 92014) for the bulk of my word processing ever since its inception. When the current version, Telewriter-64, became available, its ability to right-justify text caused me to

"CoCo users are lucky where spreadsheets are concerned."

abandon my second word processor.

I previously used Trans Tek's C.C. Writer (194 Lockwood Lane, Bloomington, IL 60108) for anything resembling formal correspondence, but now I had no motivation for continuing with two programs for one job.

Telewriter's new-found ability to produce ASCII files doesn't hurt, either. Now it's much easier to use auxiliary programs such as spelling checkers; I use Spell 'N Fix (Star-Kits, P.O. Box 209, Mt. Kisco, NY 10549). I can read and edit files generated by some other programs, too.

The whole topic of file compatibility between programs is something of a sore spot with me, incidentally, and I'll return to it later.

I've already mentioned using Pro-Color-File for heavy file management. This is an area in which I indulge myself a little; I have two other file managers in my household.

I still use Trans Tek's C.C. File for casual, unstructured applications like my file of addresses and phone numbers of CoCo vendors. Some of the entries include reminders of what the vendor produces, others do not, and the whole thing is gloriously loose. Ditto for my family's file of favorite restaurants. C.C. File's lack of structure and limited command set are especially welcome since I call on it sporadically without reference to the documentation.

I also have specific applications for Radio Shack's Color File. For some time, I have used it to maintain a text file I call COCOFACTS, which contains notes about various aspects of Color Computer operations.

This is where I keep track of all the PEEKs and POKEs I use in programming. How else would I remember where the Next-Data-Item pointer is? Color File's two-level indexing scheme and on-screen prompts seem right for these applications.

In principle, I could probably handle all my file management chores with one program. I have used Homebase (Homebase Computer Systems, P.O. Box 3448, Durham, NC 27702) and can vouch for its ability to handle data and text files.

The trouble is, I've become comfortable with my existing three-tier system and don't feel like adding a fourth component or translating all my data files. The urge I had to unify my word processing is lacking here.

CoCo users are lucky where spreadsheets are concerned. For a while the Spectulators, disk and ROM pack, were pretty much the whole story, and their capabilities were relatively limited. Then Trans Tek's C.C. Calc acted more like VisiCalc *et al.*, but was hampered by being written in Basic.

Then this spring Elite Calc (Elite Software, Box 11224, Pittsburgh, PA 15238) became available, and suddenly unmodified CoCos have a full-blown spreadsheet. In the meantime, FLEX users could call on the big-league power of Dynacalc (Computer Systems Center, 13461 Olive Blvd., Chesterfield, MO 63017).

I've used all four, and still have both Elite Calc and Dynacalc files in abundance. I could happily switch to 100 percent use of either program, but other considerations (see the end of this column) make me want to stay sharp on both. That's not too tough; Elite Calc has a simple command syntax, while Dynacalc's resembles that of SuperCalc, the CP/M-based spreadsheet I use regularly at my office.

Those are my big guns—the programs I use almost daily. Of course, a lot of utilities come into play for special purposes: Master Control (Soft Sector Marketing, 6250 Middlebelt, Garden City, MI 48135) and Colorkit (Arizin, P.O. Box 8825, Scottsdale, AZ 85252) to name two.

THE COLOR KEY

I've also been experimenting with several math and business graphics packages and expect to become a steady user of one or more, but it's early to declare my allegiance. My reviews have been appearing here and in *HOT CoCo* on a fairly regular basis; look for more on graphics over the next two or three months.

Odds and Ends

I'd like to return to the question of the Color Computer versus other serious 8-bit machines. The CoCo programs I use (and many of their major competitors) are the equals of the better-known applications programs for other computers. I use CP/M software almost daily, but that doesn't mean it overwhelms me.

Both Elite Calc and Dynacalc are better in some respects than early versions of Supercalc, which is itself arguably better than VisiCalc. It has taken the newer Supercalc 2 to incorporate some features of the CoCo programs: the ability to sort a spreadsheet by row or column data, for example.

Telewriter-64 is far easier to use than WordStar, and does a perfectly satisfactory job on anything but the most specialized text processing. For that matter, Super Color Writer (Nelson Software Systems, 9072 Lyndale Ave. South, Minneapolis, MN 55420) can take on WordStar, too.

As for file and data-base managers, I haven't done enough work with CP/M material to form a definite opinion. I know that dBase II is very powerful but quite complex—more complex than Pro-Color-File, Homebase, or several other top CoCo file managers. The CP/M program might do all kinds of exotic tricks, but for the moment I feel that CoCo users have some competitive software at their command.

What troubles me, though, is that it's a real chore to use the output of one program as the input to another. Life would be a lot simpler if I could pop an Elite Calc data file into Radio Shack's Disk Graphics to produce a bar chart, or if I could get such a chart into a Telewriter report.

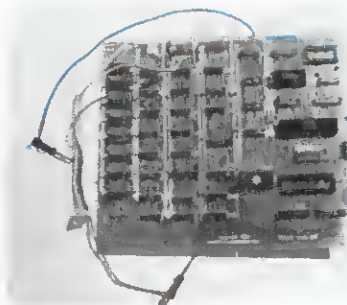
Of course it's possible to write a conversion program for almost any specific application, but wouldn't it be nice if CoCo programs talked to one another with less fuss?

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programs to prepare indices and footnotes, for example. I don't think this desire for well-integrated software is a fetish of mine alone. The best feature of Apple's Lisa is its elaborate suite of business programs, and integrated packages like 1-2-3 promise to be huge sellers in the IBM PC community.

Clearly, someone else cares about this problem. The existence of a standardized operating system helps, and maybe the official blessing of OS-9 will result in better-integrated software for Color Computers.

Super CoCo

The 64K Color Computer and the Color Computer 2 are now appearing in Radio Shack catalogs, and the first samples of the Dragon 32 are out. The former and the latter have some appealing features, but neither is perfect.

Therefore, I'd like to share a few fantasies with you and set down some of my thoughts for a dream machine. This isn't a truly radical proposal, just some ideas I'd like to see incorporated into a next-generation Color Computer.

I'll start with a baseline machine having 64K of RAM and the best of the full-travel keyboards. Now, how about adding an official clock speedup to 1.8 MHz. Maybe the operating system would have to shift in and out of high gear for I/O, but this shouldn't concern the user. Add an internal muffin fan if necessary to preserve IC lifetimes.

The machine needs a few user-definable keys like the ones on the Model 100 and some of today's add-on keyboards. I hope software vendors would prepare patch areas so you could add customized definitions for such keys to their programs. One of the things WordStar does right is allow control/digit key to represent a series of keystrokes, making it much easier to enter frequently used command sequences.

*"I'd like to
share... my thoughts
for a dream machine."*

A baseband video output for use with a monitor could be a monochrome signal, and would be used primarily for word processing and an 80-column spreadsheet. The Dragon 32 has baseband and RF outputs already.

I'd like better A/D converters. Eight-bit resolution would be nice, to increase today's 64 resolvable analog input levels to 256. An integral Centronics parallel port should go along with the RS-232. Let's get serious about printing, and do away with the external boxes and PC boards.

I want gold-plated cable connectors everywhere. Weak links like the CoCo's disk controller connectors aren't charming idiosyncrasies; they're embarrassing flaws.

Dedicate a second 6809, with perhaps another 64K of its own RAM, to control the display. I'm not kidding; at least one such machine already exists in Japan. It would be great to have this kind of power for graphics of all kinds. Consider the possibilities of 40 PMODE 4 pages, for starters.

One of the nicest things about designing dream machines is that you don't have to worry about cost.

The End

It's the end of the road, ladies and gentlemen. I've enjoyed writing The Color Key, and I hope that many of you will find something of interest in the new FLEX/OS-9 applications column.

I don't intend to abandon the rest of the CoCo world. One of my major current projects is a book in which I'll treat applications software in more detail than the column/review format permits.

With any luck at all, the book will be out in the autumn of 1984. The publisher is Scott, Foresman.

In the meanwhile, I'll see you in *HOT CoCo*. ■

Contact Scott Norman c/o The Color Key, 80 Micro, 80 Pine St., Peterborough, NH 03458.

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Perhaps the most powerful asset of any 16-bit microcomputer is its ability to become an office or interoffice hub that other terminals can access. Its multi-user and multi-tasking capabilities blur the fine line that separates minicomputers from microcomputers.

Terminals, commonly referred to as work stations, are typically less expensive than complete computer units. Using several terminals to tie into one host computer allows many people to take advantage of the main computer simultaneously.

The host computer, in its standard configuration, has a hard disk drive connected to it. All of the terminals can access information stored on the same hard disk.

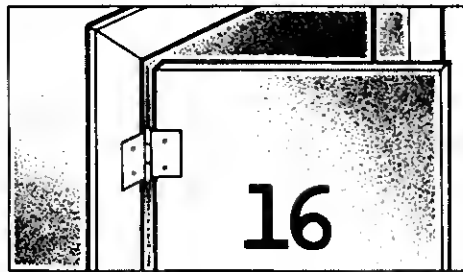
Currently, Radio Shack offers two ways to add external remote work stations to the Model 16. These networking systems are called Arcnet and Xenix.

Arcnet

Arcnet, an acronym for attached resource computer network, lets you connect up to 255 computers to the Model 16.

The terminals can use all of the peripherals connected to the host machine. These include both floppy and hard disk drives and printers. You cannot use the host machine, called a file processor, as a terminal. Its keyboard and video display aren't available to the operator.

Arcnet also runs on the Models II and 12. It doesn't require the MC68000



Arcnet and Xenix hubbub

board, but every computer in the system must have an Arcnet circuit board installed. Have your local Computer Center do this.

Hubs, similar in function to a TV antenna splitter, join the work stations and the host machine together. One cable connects to a hub's input and provides several outputs to feed other work stations. Passive hubs let you connect together four units up to 200 feet from the hub.

Active hubs boost the data signals with internal circuitry so you can place terminals as far away as 2,000 feet from the hub. Combining many active and passive hubs together yields a maximum distance of four miles between the farthest work station and the host computer.

Obviously, Arcnet is a good choice for multi-user applications where work stations are located in different buildings (such as a college campus).

The owner of multi-user work sta-

tions must run the necessary cable wires through the buildings. Radio Shack computer technicians help with the installation of their computers in an Arcnet system but you must get an electrician to prepare the necessary wiring.

We haven't had the opportunity to work with an Arcnet system and welcome comments from readers who use one. Our understanding is that it operates at a speed of 2.5 million bits per second. With that kind of speed you feel as if you are the only user on the host computer.

Xenix

The second multi-user system currently available is TRS-Xenix, or simply Xenix. In contrast to Arcnet, which is a hardware configuration, Xenix is software based and requires no special circuit modifications on any of the system's microcomputers. Since it uses the MC68000 microprocessor, you need a Model 16, 16B, II/16, or 12/16 to run it.

Unlike Arcnet, the host computer's video and keyboard are available as a work station. However, you can connect only three terminals (including the host) at one time. The other one or two terminals interface by way of the two RS-232 jacks on the back of the host computer. A null modem adaptor does the job along with RS-232 cables.

Under Arcnet, each work station is a complete computer, not just a data terminal. Xenix requires that only the host machine be an independent computer.

As of this writing, you need a hard disk drive to run the system, but a floppy

Assembly-Language Corner

Prior to displaying any information on a video screen, it's usually necessary to clear the screen and position the cursor at a point where you want to begin printing. This month we take a look at some of the supervisor routines available to perform these screen formatting functions.

The video character generator circuit in the Model 16 is identical to that of the Models II and 12. Therefore, all graphics characters and ASCII codes are compatible.

Normally the screen format of these computers gives us 80 character positions horizontally and 24 vertically.

The video generator is capable of printing characters in a larger mode. While the vertical count remains 24, you can double the width of each letter. Thus, in the large character mode, a maximum of 40 letters fits on a horizontal line.

Also at our disposal is an inverse

A-L Corner continued on next page

version is in the works. Naturally such a version is limited due to less disk space on a floppy.

Xenix's basic structure builds around Western Electric's popular and established Unix operating system. Xenix comes from a thoroughly tested program in the field for 10 years.

Since more than one person can work on the same disk file at the same time, imagine the disaster if two people try to write the same record to a file simultaneously. Fortunately, Xenix designers

took this into consideration. The program doesn't allow two users to write information to the same record and accidentally lose data.

Xenix divides the computer's RAM into separate sections for each user. In this way, each of the two or three users can run programs independently. One can run payroll while another works on accounts receivable, for instance. Xenix runs with a minimum amount of 256K RAM. However, certain combinations of programs run simultaneously may

require 384K or even 512K.

Both Arcnet and Xenix have their pros and cons. Your choice depends on your business's particular needs. Xenix doesn't require you to make any hardware modifications to existing computers; Arcnet does. But Arcnet handles up to 255 computers; Xenix accommodates only three. With Xenix, the remote work stations need only be data terminals such as Radio Shack's Model DT-1. Under Arcnet, each work station must be a computer. ■

A-L Corner continued from previous page

video option. Normally the background of the screen is unlit or black and the letters light up (green or white, depending on your machine). You can reverse this to cause the background surrounding a letter to light up and the letter itself to appear as a darkened area within the block.

Built within the disk operating system is a routine (referred to as a supervisor call) that you can use to establish the size of the letters and the normal/inverse printing font.

Placing a zero into byte-offsets 6 and 7 of the SVC block (a buffer area you set up to pass values to the DOS routine) switches the video size to the 40-character-per-line mode. A value of 1 placed there produces 80-character lines. In byte-offsets 8 and 9, a zero indicates inverse video and a 1 indicates normal printing.

The supervisor number that identifies this routine from other supervisor calls is 7. Always place the identifying supervisor number in byte-offset zero of the buffer. The set-up to call this routine looks something like this:

```
LDA      .A0,SVC BLOCK
MOVW     @A0,#7
MOVW     6@A0,#1
MOVW     8@A0,#1
BRK      #0
RET
SVC BLOCK
RDATA    32,0
```

Use the move-a-word (movw) command to load the necessary values into the buffer area. This is an indirect addressing mode where register A0 stores the address pointing to the location of the SVC block buffer.

With the values you use in the example, prepare a normal screen format—80 characters per line and no inverse video.

Supervisor call 7 automatically performs two other functions. It clears the screen (similar to the Basic CLS command) and it homes the cursor—moving it to the top leftmost position on the screen.

You can use another supervisor routine to clear the screen. This is call number 8 which sends a character to the video display. Examine the machine's ASCII code chart in the owner's manual and note that the decimal number 30 is a control code for clearing the screen. By sending this ASCII code to the routine that prints a character on the display, you can clear the screen. However, unlike the last routine, this doesn't set up the inverse/normal and 80/40 screen formats.

```
LDA      .A0,SVC BLOCK
MOVW     @A0,#8
MOVW     6@A0,#30
BRK      #0
RET
SVC BLOCK
RDATA    32,0
```

Positioning the Cursor

Before printing any letters or graphics characters on the video display, you may want to position the cursor at a specific point to start printing. Supervisor call number 10 lets you place the cursor at any printable location on the screen.

You must move values for the horizontal (x) and vertical (y) coordinates into the SVC buffer area to instruct the computer as to the row and col-

umn on which you desire to place the cursor.

Place the value for the row position in byte-offsets 6 and 7. The row position refers to the number of lines down from the top of the screen. Offsets 8 and 9 store the column position. This is the number of character positions from the left-hand side of the screen.

Since there are 24 lines down the screen and 80 positions across, halving these values to 12 and 40 places the cursor in the center of the screen.

```
LDA      .A0,SVC BLOCK
MOVW     @A0,#10
MOVW     6@A0,#12
MOVW     8@A0,#40
BRK      #0
RET
SVC BLOCK
RDATA    32,0
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Figure 1. Monty and Eric play Scrabble.

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Our reviewers use a five-star rating system. One star represents the low end of this spectrum, while five stars represent the spectacular and high end of the spectrum.

★★★★

Monty Plays Scrabble
Tandy/Radio Shack
One Tandy Center
Fort Worth, TX 76102
Model III, 32K
One disk drive
Back-up limited
\$34.95

by Eric Maloney
80 Micro staff

Monty Plays Scrabble isn't going to win any tournaments. But it's good enough to give the average player a run for his money, and challenging enough to give the experienced player a stimulating practice partner.

To play Monty, you need a Scrabble board and a good dictionary. Either you or the game can pick the tiles. The program provides a board on the screen, showing you where it placed its word and letting you indicate where you want yours.

Among other features (see Table 1), Monty gives you four skill levels, keeps track of the score, and lets you save a game in progress. A game takes about one hour and 40 minutes to play.

But enough detail. What kind of Scrabble does Monty play?

At first, I was disappointed. I won my first game by the depressing score of

468 to 288, and took the next five as well. The average tally was 431 to 302. This, I thought, is no way for a computer with a 54,000-word vocabulary to perform.

But Monty surprised me in game seven, reeling off three seven-letter words en route to a 440-383 win. And while it hasn't beaten me since, it has occasionally given me a game worthy of a capable human partner.

A Typical Game

The best way to demonstrate Monty's abilities is to recount an actual game. This one is our eighth, and is fairly typical. We play at the highest (Scholar) level, and Monty goes first. Figure 1 shows the final board.

1. My letters: FTAODRT. Monty starts off with CAY, whatever that is. I counter with FART. (So who says Scrabble has to be polite?) "Good play!" Monty responds. He says that a lot, even for words like IT. Score after one turn: 16-26, my lead.

2. Letters: *IINODT. Some good possibilities here—DICTION comes immediately to mind. I wait patiently while Monty thinks; it takes him about three minutes of disk I/O to make a move.

After much grinding and gnashing, he plays MOAN, MAY, OR, and AT for 22 points. Not too bad. Since I have no place to put DICTION, I play

DICTION instead for a quick 65. "Very great word!" Monty exudes. Monty might have an elephantine memory, but he has yet to learn how to use adverbs well. Score: 38-91.

3. Letters: ETEEOID. Monty's revenge. I need to get rid of some of these E's. Too bad EDICATION isn't a word. What's taking Monty so long? I could spin off a game of Galaxy Invasion in the time he needs to think.

"Aha!" he exclaims. That must mean he's done. He lays down GAP, AD, and PI for 19, and opens up the triple word score. Unfortunately, I can't use it for anything. I play DECEIT and GAPE for 23. Score: 57-114.

4. Letters: RHQPOOE. Stuck with the Q—and with no U in sight. "I'll be ready soon," says Monty. I've heard that line before. Think I'll go change my oil. He finally plays BUM, BO, and UN. Wait a minute—UN??? Monty's played some weird words, but this one's a bit too much. Seeing, however, as I don't have an official Scrabble dictionary, I let it go.

Figuring that two can play the weird word game, I put down HOOPER, HUN, and OM. But wait—Monty challenges OM! Is it a word? he asks. I look it up in my Webster's, and sure enough, there it is. "Monty regrets his error," he says. Score: 76-160.

5. Letters: IEARGDQ. Monty loses his turn for an unsuccessful challenge.

Taking full advantage, I play AGED, BOA, and HUNG for 25. Score: 76-185.

6. Letters: IEARGQLQ. This rack looks suspiciously familiar. Monty starts thinking. I go out for dinner and a drink. I return to find that Monty has played BUNG. Isn't he a character in *The Wizard of Id*? I play GLARE. Score: 97-207.

7. Letters: OKSVXQI. Talk about a constipated rack. Monty plays TOWEL for 26. I counter with X1, XI, and IT for 31. XI is one of my favorite Scrabble words, and I'm delighted to be able to play it twice on one move. Score: 123-238.

8. Letters: OKSVTQC. It's getting worse. Monty plays IDS and XIS for 18. I put down LOCK for 30. Vowels! I need vowels! Score: 141-268.

9. Letters: ERSVTQE. That damned Q! Monty plays RUIN for 15, I can't take it any more and exchange my Q, getting an A in return. With my luck, I'll pick up the Q again later. Score: 156-268.

10. Letters: ERSVTAE. Monty plays YARNS for 24. Getting rid of the Q pays off—I play AVERTERS for 62. Score: 180-330.

11. Letters: OLIEQW. There it is

- 1 Exchange tiles
- 2 Pass or forfeit
- 3 Save game to disk
- 4 Current totals
- 5 Check your tiles
- 6 Change skill level
- 7 End the game

Table 1. Monty plays scrabble options.

again. Monty plays JEE for 26. I play WILIER for 18. Score: 206-348.

12. Letters: VIZNOOQ. I shout at the Q to stop torturing me. Monty dives into the well of contemplation; I go reshingle the house. He finally puts down HATSFUL for 26. He picks up the remaining tiles, thus sticking me with the Q for all eternity. I play AZO for 32. Score: 232-380.

13. Letters: NVIOQ. Monty plays EASE, ETA, DOS, and WE. DOS! This is too much. I play VIOL for 14. Score: 257-394.

14. Letters: QN. The end is near. Monty goes through his usual gastrointestinal tremors and lays down VI* A for 12 points. That, as they say, is that.

Final score: 280-383.

Final Comments

Clearly, a huge vocabulary doth not a Scrabble player make. You need to be a good strategist, too. Monty is not; it is apparently programmed to go for the highest possible point total, whether that means throwing away an S, breaking up a potential seven-letter word, or opening a triple-word score for its opponent.

Monty wins an occasional game, but it is through brute force rather than cunning.

Still, you don't need a great opponent to exercise your own Scrabble skills. Monty gives you enough of a challenge to keep you from getting bored. And it sends you to your dictionary enough times to increase your own vocabulary. In recent games, it has spun off such words as indium, llano, uta, rabbet, vug, aff, eme, and dommir.

One final note: Monty Plays Scrabble allows you only one back-up. This is a serious problem with a program that accesses the disk some 200 times per game. Monty could have a short life if you don't figure out a way to break the protection scheme and give yourself a full supply of copies. ■

★★★★½

The Statistician

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by John Dunkelberg

The Statistician is an excellent statistical and forecasting system that contains a wide variety of simple and sophisticated statistical analyses. The program is especially useful for business forecasting and complex statistical analysis. The Statistician is also an excellent tool for an instructor in an elementary or advanced statistics course.

The Statistician is completely menu driven so it's easy to use, even for a microcomputer novice. Thirty minutes after reading the documentation, I was running my first regression.

Multiple Regression

One of my principal reasons for ac-

quiring The Statistician was the multiple regression package. The Statistician contains five different regression procedures including Stepwise, Ridge, Backward Elimination, and All Subsets regressions. I haven't seen Ridge, Backward Elimination, or All Subsets procedures in any other statistical package for micros.

You can create large models with up to about 50 independent variables. This is enormous, especially when compared to the Radio Shack statistical analysis program that only allows five independent variables.

The output (see Table 1) closely resembles that of mainframe packages and includes t values for the individual coefficients as well as their standard errors. Also, the program includes the Durbin Watson statistic, which is useful in residual analysis and is found on few other statistical programs for microcomputers.

You can list or print the variance/covariance and sums of squares matrix as well as the correlation matrix of the estimates. Residual analysis is also

good. You plot residuals or list them with the actual and predicted values on the screen or printer.

Another feature I like is that the program saves the predicted values to disk. This lets you estimate simultaneous equations models. In addition, the Sort utility ranks the residuals by actual or predicted values of the independent variable.

I tested The Statistician's accuracy on the Longley data, a benchmark for testing statistical accuracy. I found The Statistician superior to the mainframe programs tested by Longley in 1967. The program's accuracy was amazing.

Data

The Statistician provides an easy data entry and editing system. You specify the number of variables, then the program displays the appropriate number of fields on the display. By pushing the appropriate arrow keys, you move around the fields or up and down through the rows of data.

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REVIEWS

become part of your data base and any of the programs in the package can use them. The edit program contains a good data report formatting system that automatically centers titles and headings and aligns data.

One of the most important components of the package is the data transformation function. It takes some time to become accustomed to this particular program, but it's worth it. Using any of the 24 transformations, you modify data or create new variables as functions of existing variables.

The transformation capability is essential for non-linear multiple regression and many techniques in exploratory data analysis. Using this feature, you can easily create the necessary variables for a polynomial or interaction regression model.

Some of the data transforms are quite unusual but occasionally useful: for example, the additive and multiplicative accumulators. These accumulators calculate the cumulative sum and product of a vector.

Some of the transformations are designed for time series modeling. In particular, the n th order lag lets you create lagged data of any specified order.

Other Features

The descriptive statistics component computes the following numerical descriptive measures: mean, median, geometric mean, harmonic mean, variance, standard deviation, maximum and minimum values, mean absolute deviation, and range. In addition, the program produces excellent frequency histograms (see Fig. 1).

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BATHS/DAT	B 4	27221.1	6765.33	4.02362
GARAGE/DAT	B 5	-5487.06	6052.39	-.906593
RESORT/DAT	B 6	40420.5	7913.66	5.10769

SOURCES OF VARIATION	ANOVA SS	DF	MSE
REGRESSION	1.67561E+10	6	2.79268E+09
ERROR	5.5722E+08	8	6.96525E+07
TOTAL SS	1.73133E+10	14	

F= 40.0945
R SQUARED= .967816
DURBIN WATSON STAT. = 2.35218

Table 1. The Statistician's output.

1 LINE = 1 OBSERVATION(S)

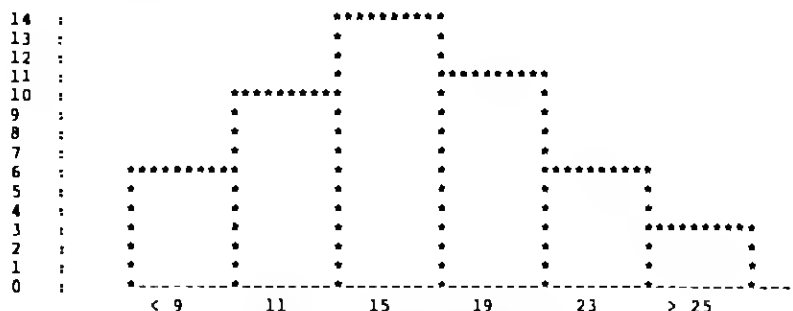


Figure 1. Frequency histogram.

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Charles Kilsch, 80 Micro Computing 12/82

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The program also permits several types of hypothesis testing, including tests on a single mean, single variance, and difference in means (paired and unpaired). The paired difference test uses the differencing functions in the transform package, then performs a test of a single mean on the differences. One-way ANOVA measures the difference in unpaired means.

The ANOVA provides one- and two-way analysis of variance; however, the program doesn't support multiple observations per cell in the two-way analysis.

The nonparametric component contains six commonly used nonparametric tests: Median, Mann-Whitney, Wilcoxon, Kruskal-Wallis, Spearman's Rho, and the Runs Test.

The forecasting program is one of the strongest available. It performs no less than eight different time series models, including moving averages, single and double exponential smoothing, sinusoidal models, Holt's two-parameter linear exponential smoothing, Winter's exponential smoothing model, and adaptive filtering.

It calculates the mean squared error and the mean absolute deviation of the forecast. The Statistician also produces tables and plots of the predicted, actual,

and forecasted values on the screen or printer.

The program generates random variables from seven different types of distributions: Normal, Gamma, Exponential, Uniform, Poisson, Binomial, and Geometric.

Another component that particularly applies to teachers and students of statistics is the sampling program. You can get sampling distributions from any data set. The program obtains all random samples of a given size if you have sufficient disk space on your system.

The documentation is well-written and tutorial in nature. Since the system is menu-driven, it's more than adequate. I quickly obtained answers to my few questions with a telephone call.

Conclusion

A second version of The Statistician with enhancements is due for release in September. The new version will cost \$295, and a regression subset will be available for \$145.

The Statistician is an excellent program for anyone interested in performing statistical analysis. Moreover, if you've already purchased statistical software, you certainly should consider acquiring The Statistician; it contains many features that just aren't available in any other package. ■

of the commands you have chosen.

Program Description

Newbasic's commands fall into three general areas: graphics commands, program development aids, and command enhancements.

Fully half of Newbasic's commands are for graphics and sound generation. Additionally, several of the enhancements and program development aids lend themselves to rapid and easy handling of screen graphics. The graphics handling abilities of Newbasic are quite impressive.

You can draw circles, ellipses, and arcs by using a single command. You can even construct figures larger than the video display, although you can display only a portion of such a figure at any one time.

The command you use is Circle. You can modify Circle with up to seven parameters, specifying the center point, radius, rotation angle, and, in the case of ellipses, the radius along each of the X and Y coordinates.

The Draw command draws straight lines. You can state 15 different parameters to modify this command. These parameters let you draw lines vertically, horizontally, or at angles that bisect the X,Y coordinate.

You can draw straight lines at any other angle by specifying the starting and ending points of the desired line. If you like, you can define the starting and ending points as points off the screen.

In effect, you can draw on a grid measuring 255 by 255. The upper left corner of the video screen is 0,0 and the lower right corner of the screen is 15,63. One of the nice effects of this is that you can make graphics rotate around this universe of 255 by 255, but they are in view only when the figure is in the portion represented by the screen.

Draw is not limited to producing single straight line segments. By using several parameters with the command, you can specify complicated figures with a single Draw.

The most interesting parameter for Draw is the X parameter that lets you define a figure as a string expression. For example, you can draw a simple rectangle with the command DRAW "R20,D20,L20,U20" (which means draw a line right 20 graphics blocks, down 20 graphics blocks, and so on). Alternately, you can define the rec-

★★★★

Newbasic 2.1
Modular Software Associates
209 18th St.
Huntington Beach, CA 92684
Models I, III, and 4 (in Model III mode)
\$39.95

by Richard Green

Newbasic 2.1 is an enhancement to Disk Basic for the TRS-80 Models I, III, and 4. Newbasic includes 49 new Basic commands. You can add any or all of them to Basic at your discretion.

The program comes on a 35-track, single-density Model I disk. This disk contains programs for both Model I and Model III users. Model III users have to run the Convert utility before they can make a working copy of Newbasic. The disk also includes four sample programs written in Newbasic

that display its capabilities.

The distribution disk does not contain a Newbasic program. It has two programs, Creator I and Creator III, each of which builds a Newbasic program for the appropriate computer. When you run the Creator program, it presents you with each Newbasic command, a brief description of that command, and the opportunity to include or discard that command for the Newbasic disk you're making.

Once you make all the choices, the program tells you the total size of the Newbasic program you've made. You must then specify a file name under which to save the Newbasic program.

Newbasic executes exactly as Disk Basic does. You must boot the system, answer the options required by the operating system you're using, then specify Newbasic instead of Basic. From here on, Newbasic operates identically with Disk Basic, but with the inclusion

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tangle as a string: BOX\$="R20,D20,L20,U20". Then you can reproduce the rectangle anywhere in the program with the command DRAW "XBOX\$".

You can do a little more magic by specifying scale, which can cause the box to be larger or smaller by factors of 1/4, with a maximum range from 1 to 255. In other words, the normal size rectangle (scale defaults to 4) could be up to 63 times as large by setting the scale to 255 with the command DRAW "S255,XBOX\$".

Over 20 other graphics commands exist, including GSAVE to save a graphics memory into a disk file and GLOAD to place the graphic file back into memory. PGET saves a specific graphic into a memory array, PPUT restores the array back into the video memory, and Paint fills in a specified video area, making it all white or all black.

These and the other graphics commands make possible the fastest graphics you can get in a Basic program. Combine the fast graphics animation with the five-octave range (from D below middle C to E three octaves above middle C) of the sound commands and you can achieve truly spectacular games effects.

The program development aids in Newbasic include 12 new commands. One of these, QUICKKEY, enables single-key entry of 39 different Basic commands. For example, when you use QUICKKEY, holding the clear key while pressing the 4 key causes CHR\$(to appear immediately on the screen.

Holding the clear key while pressing the 5 key displays INKEY\$, and pressing C displays CMD". It takes a while to become accustomed to QUICKKEY, but once you gain familiarity with it, you'll find it a real time saver.

Another nice feature, the DEFKEY, lets you use any 10 keys to call an entire string of characters. One key can call a maximum string length of 127 characters. All 10 keys can call a total of 221 characters.

NTRON is a program tracing routine that lets you set a specific range of program lines you want traced. Additionally, you can specify any expression that you wish traced, and NTRON returns the value of that expression each time the program encounters it.

Yet another tracing function is

SPOOLON used in conjunction with the PON command. PON sends everything displayed on the screen to the printer. Preceding PON with SPOOLON sends everything from the screen to a disk file. You can then redisplay the disk file on the screen or send it to a printer. This way, you can make a permanent copy of the working of a program.

The handiest program development command is LOC.. LOC. followed with a string you want found searches a Basic program for that string. For example, if you want to find and change X\$ to Z\$ in a program, you could find X\$ with the command LOC."X\$".

Newbasic searches for the first occurrence of X\$ in the program with which you are working. You can change X\$ to Z\$, then look for the next occurrence of X\$ with the command LOC.. If you want, you can do this for the entire program.

Among the Basic enhancements are the commands Call, DPEEK, DPOKE, and Do...Until. You use Call to call a machine-language subroutine. With this command it isn't necessary to use DEFUSR to identify the subroutine. You can locate the routine in high memory at will.

You can follow Call with the exact memory location of the routine in either hexadecimal (hex) or decimal form. Alternately, you can follow Call with an expression that corresponds to the routine's location. You can use any number of routines with this command.

Think of DPEEK and DPOKE as double PEEK and POKE. These commands return and insert 2 bytes into memory at the specified location and at that location plus one. The number returned is in the most significant byte, least significant byte form.

Do...Until lets you loop a routine that continues as long as the test following Until isn't met. The Until test can be any logic or arithmetic expression that you want tested. You can nest up to 10 of these loops (one Do...Until expression inside another).

The manual for Newbasic is a spiral-bound book showing each command. It includes an explanation of the command and one or more specific examples of its use.

The explanations are reasonably simple, but you'll need some knowledge of Basic and of programming to understand

them. This isn't a serious flaw, as few neophyte programmers have any use for a set of enhancements like Newbasic.

The manual's best feature is its installation instructions. These step-by-step instructions tell you how to install the program, with specific instructions for TRSDOS, LDOS, DOSPLUS, and NEWDOS80.

Conclusions

Newbasic seems to be a reliable program. Try as I might, I couldn't get it to crash. Nor was I successful in finding any bugs in the time I was able to use Newbasic.

The program development tools I discussed are fairly valuable. The trace functions could have saved me hours of debugging time if I'd had them in the past.

The spooler functions are much easier to use with a Basic program than the spooler that comes with NEWDOS80. And once you've become familiar with the use of QUICKKEY, it saves hours of typing when you are keying in a Basic program.

If you're writing a program that requires any amount of screen graphics, Newbasic greatly simplifies your task. However, the graphics commands take some practice to use easily. Most have several optional parameters, and the results of the parameters can be surprising.

Circle is initially confusing. It begins drawing each circle from the three o'clock position on the screen. For the last 23 years, in flying and in reading blueprints, I've used the 12 o'clock position (top of the screen) as zero degrees for circles and arcs. It took quite a while for me to consistently get the results I expected from the Circle command.

Once you become accustomed to the commands, they are fairly easy to use. You'll probably need to keep the manual handy if you're attempting complicated graphics, but straight lines are a snap. With a little practice, you'll find that setting up formatted screens for user input is actually easy with Newbasic.

The program's greatest value, however, is as a game development tool. The rapid graphics and sound generator make near-arcade results easily achieved. ■

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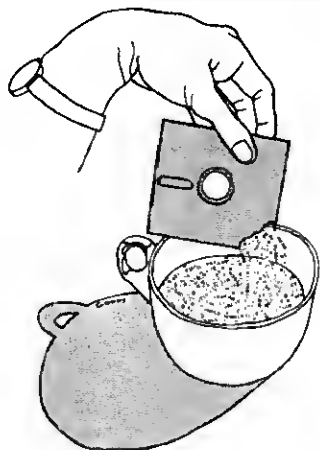
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REVIEWS



★★★★

Instant Assembler
Mumford Micro Systems
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by William J. Schauer

Instant Assembler, a complete Assembly-language development system, provides many enhancements to the Radio Shack Editor/Assembler. It's a good system for beginning Assembly-language programmers, and an adequate system for advanced programmers.

Instant Assembler is unique from other editor/assemblers in that it assembles code as you type it in, line by line. This way, you catch mistakes without the tedium involved in re-editing to correct errors that occur on assembly and later debugging the program for logic errors.

Instant Assembler contains an editor to create your source files, a built-in symbolic debugger, and a linking program that lets you create separate modules and link them together into a single program.

I tested the program under TRSDOS 1.3 on the Model III, and under LDOS 5.1.3 on my MAX-80. The manual states that the program runs under most popular DOSes for the Model III.

This package includes a program disk and a 65-page user's manual. The program disk is a TRSDOS data disk. For those of you with a single drive system, the disk self boots into a special pro-

gram that transfers the programs to your system disk.

The programs include the Instant Assembler program, three versions of the linking loader, a stand alone version of the debugger program, and a program to restart the assembler with the source file in place (if you have to reset during a debugging session). The main program, DSKIAS, contains the editor/assembler and a built-in debugger.

In the traditional method of creating an Assembly-language program, you enter your source code with an editor, then run the assembler. The assembler checks the syntax of each source statement, and generates machine code or an error message. You then re-edit the source file to eliminate errors and try the assembler again.

Once you have an error-free source file, the assembler generates object code, the machine code for execution. Since neither the editor nor the assembler checks for logic errors, you must debug the object code. Most operating systems include a debug program.

The author of the Instant Assembler takes a different approach to Assembly-language programming. This program assembles the source line when you hit the enter key while in the edit mode.

It checks for proper Z80 syntax of the opcode and operand data, and it looks for any duplicate use of the label. It also checks the range of relative jumps. If you have any errors in the line, the system reports the error and places you in the line edit mode with the cursor at the first character in the offending field.

After you finish your source file, you can assemble it directly into memory and debug your program with the built-in debugger. Since the source file is still in memory, you can also debug using the symbol names in your program.

If you discover an error, you can return to the editor mode, correct the bug, and try again. Having all these programs in memory at one time helps speed up the process of developing an Assembly-language program.

The Assembler

The assembler portion of the program is actually both editor and assembler. The editor accepts text from the keyboard and places it in the proper fields for the assembler. The input data is in the form of Z80 mnemonics and comments.

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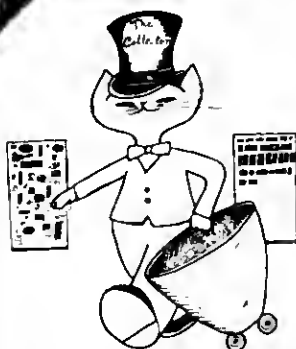
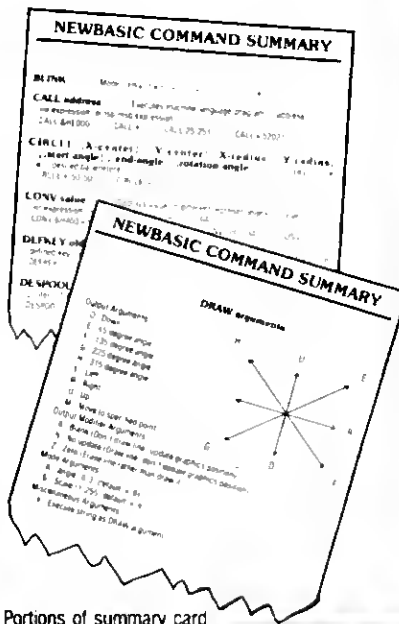
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2000	713.3	7.8	91.4

(Typical garbage collection delays.)

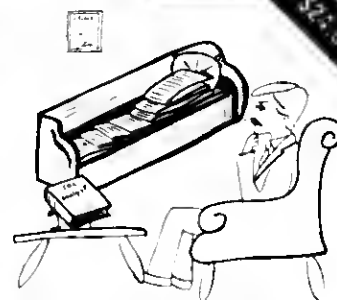
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The manual covers each of the 37 editor commands in enough detail to let even a beginner operate the program. If you're familiar with the TRSDOS Basic line editor, you already know how to use most of the line editing commands.

The assembler expects the input line to follow a fixed format. You can enter an optional six-character label as the first field. If the first character of the label is the ampersand, other program modules can use this label. In Z80 talk, this label is global or public. If the label doesn't have an ampersand, it's known only to the current program module.

The next field is a four-character opcode field that can contain any known Z80 opcode. It can also contain two undocumented Z80 opcodes that let you access the upper and lower halves of the index registers separately.

The last field, the operand field, can contain up to 45 characters and include any type of operand data or comments. If you want a comment, enter a semicolon followed by your comment. However, you don't need to align your comments; the editor does this automatically.

The editor/assembler works quickly and efficiently to help you produce Assembly-language source code. On a global level, the editor has commands to insert code, delete lines, and move blocks of code from one area to another.

It's possible to list your source code to the display or the line printer. When you send code to the printer, the program paginates it, but doesn't add a title to your list. You can also save code to the disk or tape. You can save source code in the Instant Assembler compressed format (a semi-assembled code) or in standard Radio Shack EDTASM format.

If you choose the latter, the program saves the source in ASCII format with line numbers. You can then edit this code with Radio Shack's EDTASM.

You can also include other sections of source code in your current program by using the Merge command, which appends one Instant Assembler file on disk to one in memory. As the program adds the source code, it checks for Z80 syntax errors, just as if you entered the code from the keyboard.

Other assembler commands let you read the disk directory, delete a file from the disk, and find instructions in the code that reference a certain label.

Another command lets you assemble your code directly to memory so you can debug it as soon as you finish without saving and then reloading it with a debugger program. You can also save your object code to disk or tape when you have a finished product.

The assembler allows only a few pseudo-ops, including the Z80 types of DEFM for messages, DEFB for byte data, DEFW for word data, DEFS for storage allocation, and EQU for symbolic equates. These have some surprising limitations.

You cannot use the EQU pseudo-op to define byte data. A statement like:

```
LINEFEED EQU 10
LD A, LINEFEED
```

is not allowed in this assembler. You can assign only word length (16-bit) equates.

You can postfix symbols with an expression, but the range is limited to -31 to +287. This means that LD HL,(BEGIN + 31) is allowed, but an expression like LD HL,(THEEND BEGIN) isn't allowed.

The storage allocation is limited to 4,095 bytes in a single DEFS statement, but you can use multiple statements to obtain greater allocation areas. The last limitation is that a DEFM statement can only define a string of 43 characters due to the length of the operand field.

You can break your message string up into several statements of 43 or fewer characters. The assembler also does not recognize any ORG, End, or DEFL pseudo-ops. The assembler automatically supplies ORG and End when you list the program.

The Debugger

After you assemble your program into memory, you can switch to the built-in debugger program called MicroMind. This program is also furnished in a stand-alone version. MicroMind has over 21 commands. As with the assembler, the manual explains each in detail.

The main routine used in the debugging process is the Step command. This mode lets you step through your program in half steps, each step broken up into a Fetch and then an Execute cycle. You can step through any area of the program including sections that might be in ROM.

When you enter the step mode, the program asks you for the first address. After you enter a valid address, the program fetches the Z80 opcode at that address. The CRT displays the machine instruction, the disassembled code, and the contents of all registers and most flags.

When you hit the enter key, the program executes the instruction. The display keeps the old information and shows the new register information. This lets you compare the before and after effects of the instruction as the program executes it. Some commands let you fast step up to 99 steps, and execute through a call that has already been tested.

MicroMind also supports traditional breakpoint debugging. This lets you set a break location in your code, then run the program until you reach the break location. The display then shows the current state of the registers. The breakpoint is not restored when you reach it; restoring a breakpoint requires a separate command.

Two blocks of memory appear on the display at all times. These blocks are 19 bytes long and you can set them to start anywhere in memory. This is handy if you want to keep an eye on a buffer in which you're changing data.

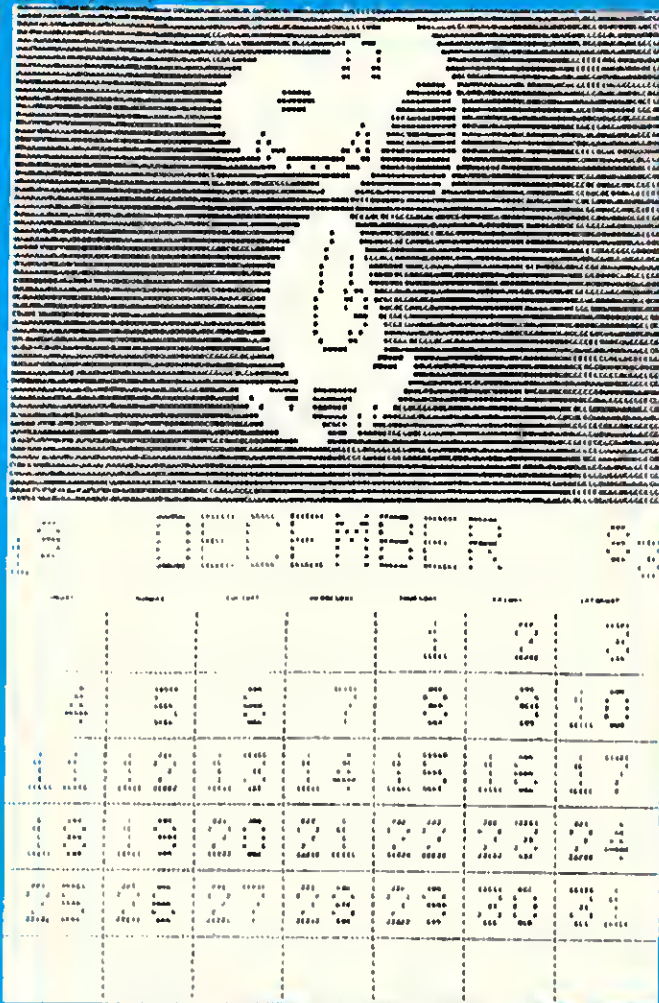
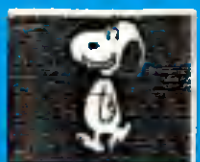
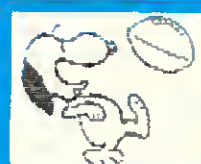
MicroMind also lets you display a block of memory in ASCII so you can detect string information. The display is 50 characters long (five lines of 10 each), and you can move it forward or backward with the up- and down-arrow keys. Other commands let you modify memory and the processor registers.

Instant Assembler includes some utility routines in the debugger program. The Find Number routine lets you search memory for any 1- or 2-byte sequence.

The Disassemble command shows you the Z80 mnemonic code starting at any first address and incrementing by one instruction each time you press the enter key. The program sends this information to the screen or to your printer. The debugger also has Hex-to-Decimal and Decimal-to-Hex number conversion routines.

The MicroMind program is easy to use and a good debugging tool. It's much better than Radio Shack T-Bug and good competition for the disk-based debug program included with TRSDOS. The disassembler feature is

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nice because you can see your code as you write it in source as well as in machine code.

The only objectionable item in the debugger is that the Z80 prime registers aren't included in any of the displays. To view these, you must execute an exchange opcode and display the registers again.

The Linking Loader

An old computer saying states: "A program expands to fill available memory." Well, in case it does, the Instant Assembler package has a program to help you manage large programs.

With the Linking Loader, you can break your source files up into related sections, define entry labels by prefixing the ampersand to them, and combine the entire program at the end to create your final object code.

The Instant Assembler contains several versions of the linker to create programs that start at the top of memory and work their way down, or start in low RAM and work toward the top of memory. All the linkers use the Instant Assembler source as their input file. You must save your modules in compressed format to use this feature.

As you load each module, the program checks it again for proper Z80 syntax, for ranges of relative jumps, and for duplicate labels. At the end of

the loading session, you receive a summary of error count and a list of undefined labels.

You can also search for the location of any symbol with the Symbol command. This lets you find the absolute address of any global symbol. If you like, the linker sends a list of all global symbols and their addresses to the printer. After you have all your source modules linked, you can save the resultant object code on tape or disk.

Conclusion

The unique feature of this assembler is the instant assembly of your source code as you enter it. This is a good feature for a new Assembly-language programmer, because it immediately eliminates simple syntax errors from your source code.

The editor lets you save your source code in the Instant Assembler compressed format or in Radio Shack EDTASM format. If you choose to save your programs in compressed format, you can save about two and a half times the number of bytes of the EDTASM format on your tape or disk.

The only serious problems with the assembler are the limitations on the range of expressions and the restriction to 16-bit equates. These problems become severe for commercial applications, but might not affect the average

home user or beginner.

The MicroMind debugger is easy to use and rivals almost any other debugger available for the Model III. The source code linker lets you break up the program into smaller sections, and later combines them into a single object program for execution.

The documentation includes a complete description of each command and examples of how to use each one. The manual uses a sample program as an example of all other portions of the development system, including the debugger and the Linking Loader.

Because of some compatibility limitations between this assembler and the Radio Shack EDTASM assembler, the manual devotes a chapter to adapting your programs to EDTASM. It would be more helpful if the author of the program corrected these limitations rather than discussing how to program around them.

In general, the Instant Assembler is a good Assembly-language development system. It provides many enhancements to the Radio Shack EDTASM system.

It also works quickly and improves user efficiency by having the editor/assembler and debugger in memory along with your program. This is a good starter system for beginning Assembly-language programmers, and a usable system for advanced programmers. ■

★ ★ 1/2

Model 100 Games #1
SilverWare
P.O. Box 21101
Santa Barbara, CA 93121
24K Model 100
\$24.95 cassette

by Eric Grevstad
80 Micro staff

If you've been waiting for high-quality, fast, machine-language games for your Model 100, keep waiting. In the meantime, SilverWare (a spinoff of *CLOAD* and *Chromasette* magazines) has converted a quartet of simple Basic programs for the portable—one or two of which are modestly entertaining if you have modest expectations.

The cassette includes two copies each of two adventures and two graphics-

oriented games. All loaded easily on the first try; the documentation includes a handy table showing their locations on a Radio Shack CCR-81 recorder's tape counter, as well as the memory requirements for each.

The games, Blockade and Reversi, can share RAM with other programs on the menu, but each of the adventures, Alexis and Frankenstein, fills most of a 24K machine.

By that criterion, Alexis (18,500 bytes) wins the Not Worth Killing Everything But ADRS.DO Award. The plot is interesting: As the imprisoned son of the late king, you must escape the usurping General Tarkaan, sail to each of four neighboring islands to collect an army, and then return to battle Tarkaan, surviving in effect four adventures and a combat strategy game.

But Alexis combines this sophisticated premise with the clumsy syntax and

limited range of an antique (1980, perhaps) Basic adventure. Given the 100's 40-column screen, even terse two-word commands are too long to fit on the same line as the windy "What is your command, Alexis?" prompt.

Other nagging lines—"You can't go that way, Alexis"; "You have boarded the boat, Alexis"—make the name begin to sound like fingernails on a blackboard.

Alexis has annoying random elements, too: Sometimes Pluto gives you the Crystal Sphere of Hades if you bring him the giant pearl, but sometimes he's cranky and demands something else.

While sailing from island to island, you have to keep an eye on the weather and type WAIT if it looks stormy. Even if you do, the program occasionally kills you off, saying "You should have waited."

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puzzles will be sorely disappointed. Alexis begins his odyssey in a jail cell, where the guards put him without removing the skeleton key he carries.

On the first island, I worried about natives or monsters but found only stuttering strings: "Alexis, you are on the shores of the island of Skiros on the island of Skiros."

By contrast, while no one would call Frankenstein a great adventure—simple two-word commands ("Unlight candle"), slow Basic that lets you type in a command before the display's processed your previous one—it's a pleasant few hours' exercise.

Frankenstein (15,000 bytes) is relatively easy, but has a couple of clues or items that form a good introduction to adventuring logic. I can't recommend it for children, though, because it involves digging up and hacking at corpses. As the last surviving relative of Victor Frankenstein, you must finish his work and activate the monster, who's short a few parts.

But once you get into it—scurrying between the mansion, the graveyard, and the old mill; trying to get at and open the safe; and dodging quicksand, werewolves, and finally the awakened monster—Frankenstein is ghoulish fun.

Like Alexis, however, it might tempt portable players to cheat. For people used to Model I/III disk adventuring, it's all too easy to hop into Basic for a simple LIST. (That's how I learned the trick of getting past the wolf; I'd never have been gruesome enough to think of it myself.)

Both Frankenstein and Alexis have one wonderful feature, the best thing about Model 100 adventuring—you can save a game in progress to RAM (your position is stored as a bunch of numbers in a 350-byte do-file), replacing disk or cassette I/O with "Save game" or "Load game" and a tap of the enter key.

Key work isn't so easy in Blockade (6,500 bytes), a semi-Centipede game in which you steer a snake around the screen, trying to reach targets and grow-

ing longer as you do so. The targets appear and disappear randomly, sometimes for no longer than an LCD flicker; each is worth a random one to nine points.

Hit the wall or your tail, or your opponent in two-person games, and you lose five points. Blockade then displays your current score and restarts with new snakes.

The word that springs to mind, especially after the opening instructions take eight seconds to appear, is "slow"; only the fastest of three speeds is at all interesting, and sluggish response makes maneuvering difficult. Rather than the Model 100's arrow keys, the Esc, tab, /, and shift keys steer single players up, down, left, and right respectively.

Two-player games are awkward. Not only is the 100's screen hard for two people to see at once, but the second player has to use the apostrophe, slash, comma, and period keys to steer, reversing the order (left hand up/down, right hand left/right) of the other arrangements

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or the Model III arrow keys.

As if that weren't enough, the game drags on until someone reaches 100 or -100 points, or until a player leads his opponent by 100 points. This can take some time. The playing options and default values (one player, sound, medium speed) are nice touches, but Blockade remains basically a dull game.

Reversi, on the other hand, is the same old Othello that's been on micros for years, but the Model 100 version is a first-rate use of 5,250 bytes. The documentation is poor—I'd never played Reversi before and learned by trial and error—but the game is neat, simple, and fiendishly challenging.

On a Model I or III, Reversi was interesting. Scaled to fit in your lap, it's an ideal armchair or plane-ride diversion.

While two can play, Reversi is best as a solitaire duel against the 100. A # sign, steered around an 8-by-8 grid with the arrow keys, lets you enter your move,

capturing enemy pieces between two of yours. Then the 100 takes its turn, moving the # sign around the board as if considering moves before making its choice and capturing even more pieces.

Games become grim, vicious fights for the crucial edge and corner spaces; toward the end, the lead swings wildly back and forth until a musical salute announces the victor. I've managed several wins and a tie, but I'm by no means through playing. Of the four SilverWare games, Reversi is the only one I'm keeping in my Model 100.

I can recommend Reversi because it takes new life in a lap-sized version, but the other Model 100 games have no real attraction except portability. Probably soon there'll be adventures with plots as elegant as the save-to-RAM feature, or arcade games that aren't anchored by plodding Basic. The Model 100 will be a great game computer. It just isn't one quite yet. ■

DB-25P plug.

Using the Microspooler

The microspooler hooks up to most standard printers, but lack of standardization in the printer industry might give you problems in getting the right kind of cable for your printer. Consolink is helpful if you need advice or help in building your own cable.

It's simple to hook up a parallel printer and microspooler. With the serial microspooler or printer, you have to set a few switches. The serial ports also have selectable baud rates. The manual is easy to follow and tells you exactly what to do.

When you first turn on the microspooler, you can perform a self-test. Press and release the reset button while holding in the copy/pause button. This is a software test of ROM (read-only memory).

If this test is successful, your printer tells you ROM is OK and how much memory is available. Now you can start filling your buffer.

The minute you start sending data from your computer to the printer, the microspooler fills up and control returns to the computer. The printer starts printing simultaneously. The status readout changes from 00 to 01 (1K) and so on as you send data.

When you stop filling the buffer, the readout decreases until it reaches 0 when the printer finishes printing. Reset the buffer to 00 if you don't want an extra copy. While the printer is running, you can press the copy/pause button if you need to change the paper or make adjustments.

When printing is complete, press the copy/pause button for one more copy of whatever is in the microspooler's memory. It's also possible to preset the number of copies (up to 99) you want before you start printing. Press the copy/pause button until the desired amount of copies appears on the readout.

You also have the option of pausing after every copy. The microspooler also has a pause on form feed function.

I found the microspooler simple to install and easy to use. It's a helpful tool if you have a lot of printing to do. The microspooler frees you and your computer to do other things while the printer works. All in all, the microspooler is a good buy. ■

★★★★

Microspooler Buffer/Interface
Consolink Corporation
1840 Industrial Circle
Longmont, CO 80501
\$199 (16K parallel to parallel)

by **Mare-Anne Jarvela**
80 Micro Technical Editor

If you've ever waited impatiently for your printer to stop printing so you could use your computer again for other tasks, here's a microspooler that makes work much easier for you.

The microspooler stores data until the printer is done, letting you continue your work. Data acceptance rate is up to 5,800 characters per second.

You can also use the microspooler between a phone modem and a printer, or the modem and your computer.

The four spooler models available include parallel to parallel, parallel to serial, serial to serial, and serial to parallel configurations. The model I describe in this review is parallel to parallel.

You can configure each model to store 16K, 32K, or 64K of data. The price is slightly higher for 32K and 64K, and serial models are more expensive than parallel.

The microspooler is small: 6.3 inches high by 2.6 inches wide by 8.3 inches deep. It's a white box with black edges that weighs two pounds, 15 ounces and stands vertically to save space.

A two-digit numeric display on the front is the status readout that tells you how much data is in the spooler or how many copies are left to run. On the front you'll also find the copy/pause button and the reset button.

"The microspooler stores data until the printer is done, letting you continue your work."

The back has two ports, one for input and one for output. The on/off switch is also on the back. Connectors for parallel ports are 36-pin Centronics compatible; the input port is the receptacle and the output port is the plug. For serial ports, the input port is the DB-25S receptacle and the output port is the

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REVIEWS

★★★★½

Using Scripsit

William J. Haga

Wadsworth Electronic Publishing Co.

10 Davis Drive

Belmont, CA 94002

Softcover, 250 pp.

\$21.95

by S.F. Tomajczyk
80 Micro staff

It's said that you can't teach an old dog new tricks. It seemed true until I began reading *Using Scripsit* by William Haga. That's when I realized that, although I've actively used Scripsit for the past year, I haven't really been using it.

Using Scripsit is truly user-friendly. It represents what a reference book should be: comprehensive and informative concerning the subject matter, readily accessible for locating specific information, and most importantly, communicative in an understandable fashion.

The book discloses everything you ever wanted to know about using Scripsit's capabilities on your Model I or III. The information applies only to Scripsit versions 3.2 and 1.0, so if you have Scripsit on a Model II the book won't be of any use to you.

Using Scripsit employs a hands-on approach to learning to get the most out of Scripsit. You should read it with your computer in front of you. William Haga presents each procedure in numbered steps that tell you what to do, what your video display looks like when you do it, and how the printed result looks on paper.

You'll never feel lost or confused. And to make certain that you won't, Haga includes exercises to test your growing skills in using Scripsit.

At the end of each chapter, a Common Mistakes section lists the problems and solutions you're most likely to encounter. Also, the left margins are filled with comments that clarify the text, provide helpful and humorous tidbits, and direct you to other sections of the book for further information.

At a Glance

The first section of *Using Scripsit* is an introduction aimed at the first-time user. In Chapters 1-7, Haga methodically takes the reader through the fundamentals of disk use, writing and formatting the video screen, saving and retrieving Scripsit files, basic editing commands, and formatting and printing a document.

The second part of the book deals with more complex applications for the experienced user. Chapters 8-15 include valuable information and explanations of Scripsit that you'll refer to time and time again. They cover block moves, search and replace routines, creative formatting, and chain loading.

They also clarify the forbidding headers, footers, and page numbering system, as well as clearly explain the Hot Zone of Scripsit's hyphenation function, and how to save a half-ruined printout without reprinting the entire document.

The best is yet to come: In the remaining three chapters, Haga shows you how to merge VisiCalc with Scripsit, create personalized form letters, use Scripsit to write computer programs in Basic, and print documents in special formats.

Continued on p. 61

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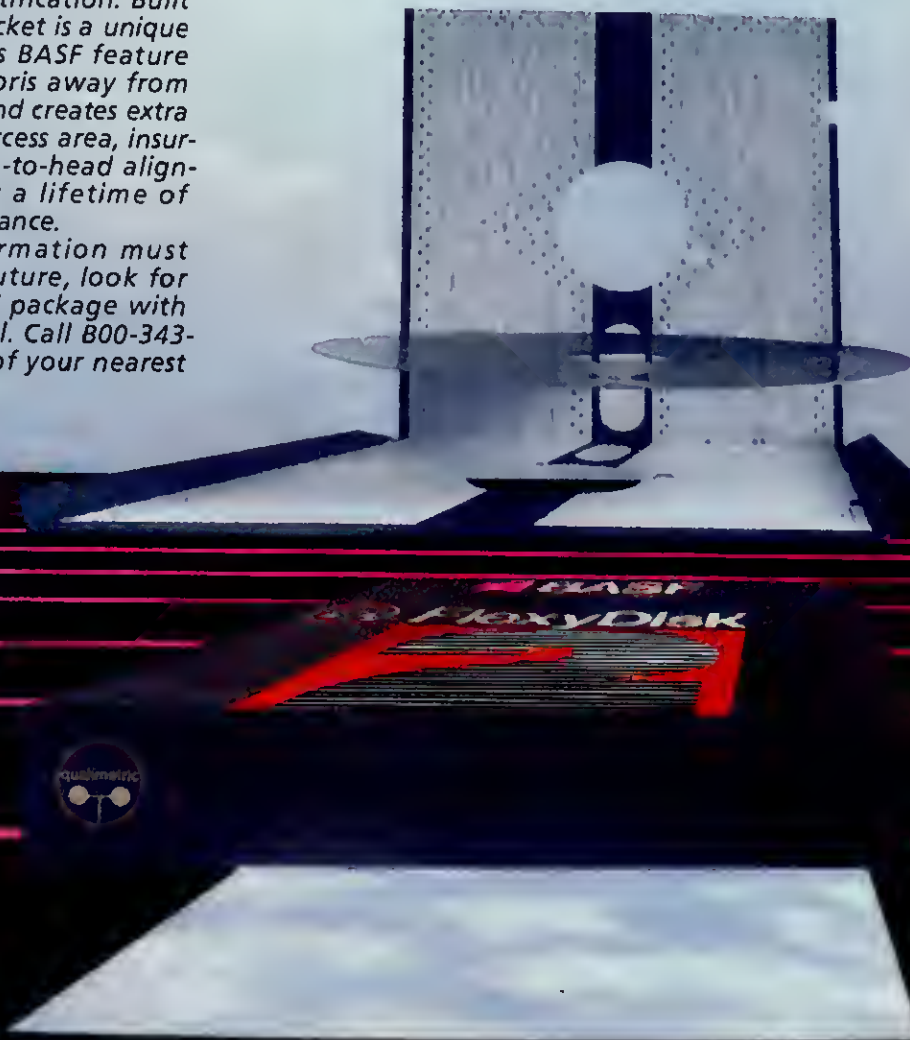
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Continued from p. 56

He explains, step by step, how to send Scripsit files by phone across town or across the globe, and how to manipulate your operating system's password protection system to protect your Scripsit files from prying eyes.

When I reached the end of Chapter 18, I was convinced that William Haga had a sadistic streak in him. Why else would he continue to throw so much valuable information at me in his appendixes?

One appendix provides the symptom, cause, and solution to errors you frequently encounter. It covers everything from Scripsit error messages to printer difficulties, and from drive unit problems to DOS troubles.

Another appendix lists reference sources that include computer magazines, books and manuals, and independent sources of equipment and software. And yet another appendix functions as a glossary for Scripsit users! The author had done the impossible: I actually learned some new tricks.

What exactly did I learn? Well, did you know that Scripsit has a widow sup-

pressor? That you can change the screen width to up to 132 characters? That with the Search command you can find several variations of a word for spelling errors? That Scripsit can hyphenate wrapped-around words with its hyphenation block?

That you can create a paragraph pantry to easily and quickly customize form letters? Or that you can chain files together in order to print and number an entire document? I didn't until *Using Scripsit* told me. Now 80 Micro's technical editors ask me for advice on Scripsit.

With the information in this 250-page book, I've found Scripsit to be much more powerful than I thought. Now I use it to finish office paperwork more quickly, write and edit chapters in my book, create and print form letters and memos, and write Basic computer programs.

For the skeptics out there, *Using Scripsit* does have its drawbacks, but they are trivial. For instance, I feel that the chapters concerned with screen edit-

ing should have been introduced earlier in the book.

This would let you go from booting up Scripsit, writing and formatting the video display, to screen editing, saving the file, and formatting and printing the document. Trivial, but it would make for a more useful chronological reference.

The only legitimate complaint I have deals with the omission of an easy reference sheet that lists in abbreviated form all the Scripsit commands and functions so you don't have to browse through the entire book for an obscure command.

Such a sheet would save a lot of anguish and time. Haga does, however, include an incomplete facsimile that lists only the screen format defaults. Useful, but not what I was looking for.

Using Scripsit is comprehensive, well-written, and useful. Every Model I/III owner with Scripsit, whether a first-time user or an old dog, can benefit and learn from this book.

It belongs next to your computer and its operating manual. *Using Scripsit* will soon become your most valuable guide. ■

★★★★★

**CP/M 2.2, MBasic 80
on the Mapper I (48K)/III (64K)
Omikron Systems
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by John B. Harrell III

Omikron Systems distributes hardware and software for TRS-80 computers that allow full implementation of the CP/M operating system—not another attempt to work around the TRS-80 internal memory structure. I used the Mapper and its software almost daily for three months. The system performed flawlessly—no glitches, surprises, or snags.

Because the hardware used in this modification is part of another review (see "CP/M III Ways," p. 122), I'll consider only the CP/M 2.2 operating system and the MBasic 80 interpreter

distributed with the hardware modification as the starter system.

CP/M Operating System

CP/M isn't just another disk operating system; it's the most widely distributed operating system for the 8080 microprocessor. CP/M derivatives now exist for the 8086 family and the 68000 family of 16-bit computers. Radio Shack's introduction of the Model 4 with CP/M reinforces the fact that CP/M has become the de facto industry standard in operating systems.

The CP/M operating system is a monitor and control program for microcomputer systems that use floppy or hard disks for back-up storage. It is estimated to be in use in over half a million microcomputer systems throughout the world.

The system distributed with the Omikron Mapper I/III modification is CP/M 2.2. CP/M is logically divided into four parts: the Basic input/output system (BIOS), the Basic disk operating system (BDOS), the console command processor (CCP), and the transient program area (TPA).

These component parts provide features found in many other systems available for TRS-80s. For example, the BIOS provides system-dependent primitive operations necessary to access the disk drives and to interface with the standard system peripherals, BDOS is the disk management part of CP/M, and the CCP provides the interface between the operator and the system.

CP/M commands break down into three categories: built-in commands, transient commands, and user-implemented commands. See Table 1 for the commands in the first two groups (standard on CP/M system disks. The latter group are those commands programmed by the user in Assembly language and executed from the disk (similar to CMD files).

In addition to the standard Digital Research software and documentation, Omikron provides many specialized features particular to the TRS-80 implementation. This documentation is provided in *The Omikron Mapper Owner's Manual*. This contains all the instructions on the Mapper's installation and the documentation for the many special

features required for TRS-80 systems.

One example of the customization Omikron provides is a sophisticated keyboard driver that maximizes the capabilities of the CP/M software interfaced with the TRS-80. Features include full keyboard debounce, a single-key control key, upper-/lowercase support with caps lock, and production of the full 128 characters in the ASCII set.

Several of the keys have control functions for single-key ease.

Omikron provides serial and parallel printer drivers to support all printer installations. The default printer driver is parallel, supporting the majority of Radio Shack hardware configurations. The routine Serial.COM (provided by Omikron) establishes the serial driver and initializes the RS-232 interface to

the default conditions established with the sense switches.

The video driver emulates a Soroc IQ120 video terminal on the TRS-80. It provides full upper-/lowercase support and maintains full graphics capabilities. Also, the video driver provides a routine that allows cursor addressing (positioning the cursor to a specific location on the screen).

Omikron provides two versions of SYSGEN and Format on the distribution disk. The manufacturer specially tailors a version of each utility to the 5¼- and 8-inch disks normally used with CP/M on the TRS-80s.

OMCOPY.COM is a disk copy routine provided by Omikron to allow more rapid back-ups. The standard routine, Peripheral Interchange Program (PIP), provides a method to copy all files from one disk to another. The operation is similar to the "back-up by class" LDOS uses or the "copy by file" NEWDOS80 uses.

To circumvent the delay inherent in this method, OMCOPY provides a track-by-track back-up of one disk to another. Options allow copying only user files, only system information, or the entire disk.

MEMTEST.COM and DSKTEST.COM evaluate your system's performance. The functions of each are obvious.

Setup.COM lets you customize the Omikron software according to your personal preferences and as certain software applications require. You can store the options changed by Setup permanently on the system disk.

TRSCPM.COM provides a mechanism to transfer files from TRSDOS formatted single-density disks to CP/M formatted disks. Both systems use a soft-sector disk; however, both sector lengths and directory structure differ. This program moves data from the TRSDOS-format system to the CP/M system.

This feature also allows moving Basic programs from one system to the other as long as you save the TRSDOS program to the disk in ASCII format. The program transfers the files sector by sector, copying extraneous information in some cases (the bytes past the TRSDOS end-of-file location, for instance).

In addition to the many utilities included on the system disk, you can see from Table 1 that the standard CP/M system disk includes a powerful context

Built-In Commands

Command	Description
ERA	Remove the specified file(s) from currently logged-in or specified disk.
DIR	List the names of all files in the specified directory on the console device.
REN	Rename the specified file to the designated name.
Save	Save the specified number of pages (256-byte blocks) to the file designated. Pages are taken from the Transient Program Area beginning at 100 hexadecimal (hex).
Type	Type (display) the contents of the specified ASCII file to the console device.
User	Allow specification of different user numbers for maintenance of separate files in the same directory.

Transient Commands

Command	Description
ASM	Load the CP/M assembler and assemble the specified program. The Assembly source code is assumed to be in Intel source mnemonics and the assembler produces 8080 machine language in the Intel hex format.
DDT	Allow dynamic interactive testing of programs while operating within the CP/M environment (DDT includes a limited disassembler).
Dump	Dump the contents of the specified file to the system console in hex form (displays the file's contents, representing each byte with ASCII letters for the hex codes).
ED	Allow the creation and editing/correction of ASCII character files in the CP/M environment.
Load	Load the assembled program in the Intel hex format and convert it to an executable machine code file.
MOVCPM	Allow reconfiguration of the CP/M system for any memory size.
PIP	Allow movement of files from one form of storage to another. You can specify many powerful parameters to control file movement.
STAT	Provide status and general purpose access to pertinent system and disk parameters from the CP/M command level.
Submit	Allow the submission of CP/M commands in a batch manner. This is similar to the TRSDOS Do command. Parameter substitution is allowed within Submit files. The compiled Submit file is executed after Submit completes. You can chain Submit commands.
SYSGEN	Allow the generation of a system disk by properly initializing the CP/M operating system on the disk.
XSUB	Extend the power of Submit to allow input to user programs as well as to the Console Command Processor.

Table 1. CP/M Version 2.2 Commands.

editor (ED), an Intel-compatible 8080 assembler (including the ability to perform conditional assembly), and a dynamic system debugging monitor (DDT).

Microsoft Basic 80

CP/M does not come with a Basic interpreter. On many systems, you have to add this feature by purchasing an interpreter compatible with the operating system. Owners of TRS-80s have been spoiled by having a high-quality Basic interpreter available at the flick of a switch.

The Omikron Mapper package comes with the industry-standard Microsoft interpreter in two versions for 8080/8085/Z80 microprocessors and CP/M, MBasic.COM 5.2, and OBasic.COM 4.51. OBasic is for those users who have software compatible with this interpreter and who don't wish to change to MBasic.

MBasic 5.2 is the most extensive and powerful Basic interpreter available for microprocessors. It meets the requirements for the Basic ANSI standard and supports many features not normally found in other Basic interpreters, such as complex string manipulation routines.

MBasic is similar in almost all respects to the Basic interpreter implemented on the Model 4. In many respects, this is the same Basic currently on the Models I and III.

The most significant difference from Model I/III Basic is in variable naming conventions. MBasic allows variables names to be of any character string (letters, numbers, and decimal point) up to 40 characters, whereas Model I/III Basic recognizes variables names with a maximum of two characters; the remainder of the variables name is insignificant.

In MBasic, you can't use reserved words as variables names but a variable name can contain a reserved word within it. This generally leads to a program error of some type in Model I/III Basic.

This feature causes most of the incompatibility between MBasic and Model I/III Basic. In MBasic, you must surround each reserved word with spaces or delimit it in some other manner. The internal structure of the tokenized programs is different.

In order to transfer Basic code from the Model I/III to the CP/M system, you must first write or edit the program

so the interpreter can clearly identify the reserved words (contrary to the programming hints that obtain maximal speed from these Basic programs) and you must store the programs on the TRSDOS disk in ASCII format. This requires a significant programming conversion for those programs written without spaces in the lines.

"New" features of MBasic include the while/wend structure for program control, the ability to call a subroutine written in another language and pass arguments to it, chaining programs while preserving variables, erasing array variables under program control, renumbering program lines, and swapping variables in a single statement. These features are new to those who have used Model I/III Basic exclusively.

One significant feature implemented in MBasic is the Call subroutine. MBasic provides a linkage to external subroutines via a Call statement.

This subroutine linkage allows preparation of segments of code using an assembler or other language translator and calls it from MBasic with a sophisticated argument list. The calling linkage is compatible with the Microsoft compilers (Fortran, Cobol, and Basic), letting you compile complex routines for speed and use them directly from MBasic.

Conclusion

As anyone experienced with the CP/M system knows, its heart is the BIOS implementation of system-specific functions. Omikron has outdone itself with a superb BIOS module.

When I ran some benchmark tests on the MBasic interpreter, I was astounded to find that this interpreter outperforms its relative in the Model I TRS-80 mode. Operating the interpreter in a Model I with no speed-up, I obtained execution times indicating a significant increase in speed for equivalent routines (MBasic compared to NEWDOS80 Disk Basic).

When you consider that MBasic allows 40-character names and requires that reserved words have some type of delimiter around them, this is even more surprising.

As with any product, the Mapper software has some negative aspects. The distribution medium is the standard 5¼-inch disk. The CP/M software is written on this disk in 35-track format with 18 sectors (128 bytes) per track.

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Portable Computer Support Group is pleased to offer these program additions. We endeavor to continue as *The Leaders in Software for the Model 100.*

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suffer a reduction of 10 percent capacity over the TRSDOS single-density format. After creating a 40-track system disk, working user storage is 81K (82,944 bytes out of 92,160 bytes due to system overhead). Compare this to the 102,400 bytes available on a 40-track, single-density TRSDOS disk.

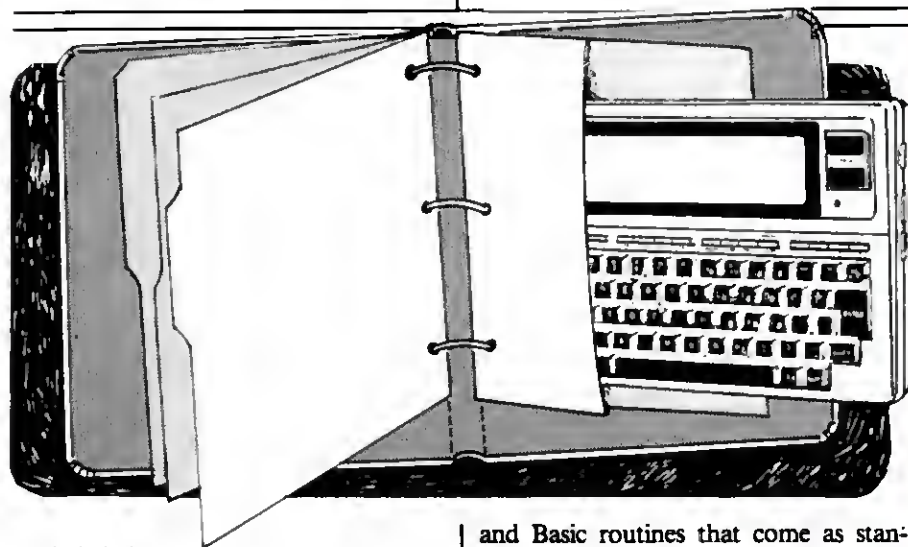
Because of the limited storage available with the 5¼-inch disk, Omikron has to delete some of the standard files resident on CP/M system disks in order to include their specialized programs. These deleted routines are available to you at a nominal fee of \$25 from Omikron and include items such as the Assembly source code to the BIOS and the Boot loader, MOVCPM.COM (relocates CP/M system BDOS and CCP for different memory configurations), and DEBLOCK.ASM (the source code for a CP/M disk deblocking algorithm).

Unlike Level II Basic, the manual sup-

plied with MBasic doesn't offer the beginner an easy understanding of the language. Since this is not the sole source of Basic for your computer, this should be no problem.

Omikron now has a new software/hardware package available that further increases the TRS-80's power. At additional cost, they will provide TURBODOS and a replacement PROM chip for their Mapper installations.

Consider the wealth of software you obtain in addition to the hardware modification. CP/M 2.2 generally retails for approximately \$150 and you must install the system (this usually means rewriting parts of the BIOS to add functions or change existing ones—no easy task for a beginner). MBasic usually retails for approximately \$249. I cannot imagine where else you can get a bargain like this. ■



★★★★★

Businesspak +
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\$89.95
SORT2 +
\$29.95
Model 100
 24K required
 32K recommended

by Carl Oppedahl

Businesspak+ is a nice collection of six programs for the Model 100. It augments the existing ROM-based word processing, telecommunications,

and Basic routines that come as standard equipment with the Model 100.

Businesspak+ contains Write+, a word processing program; EXPNS+, a simple spreadsheet program; Put+, a text entry program; Sort+, a routine that sorts records entered through Put+; Telex+, a package that lets you use Action Telex, a commercial telex service; and Graph+, a program that graphs data entered to EXPNS+ on the Radio Shack DMP-100 printer.

Each program runs in Basic and relies occasionally on a machine-language routine hidden in memory. In addition, each relies on a corresponding do-file containing various operating parameters. You can change the do-file, often called a SPEC file in the documenta-

Continued on p. 69

MEDIC 80



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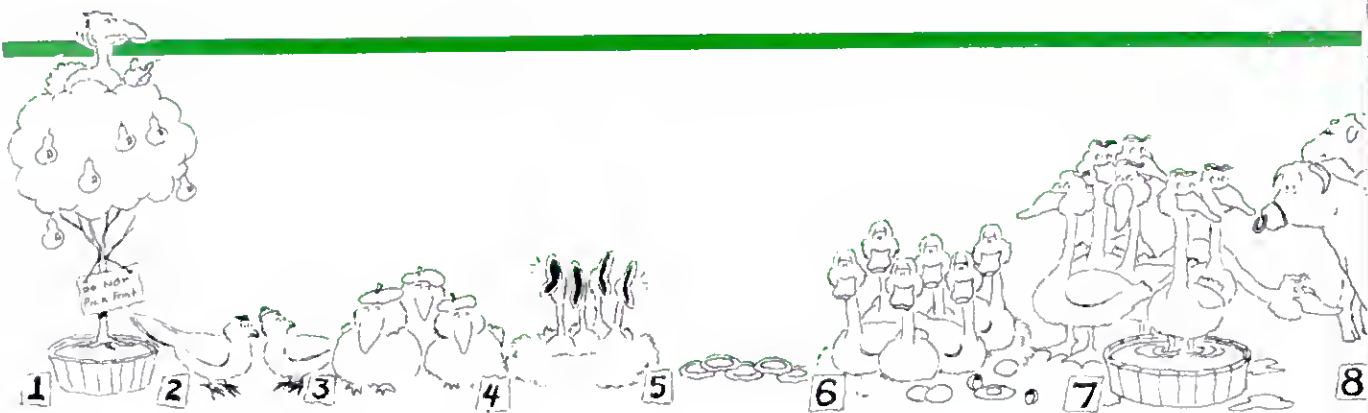
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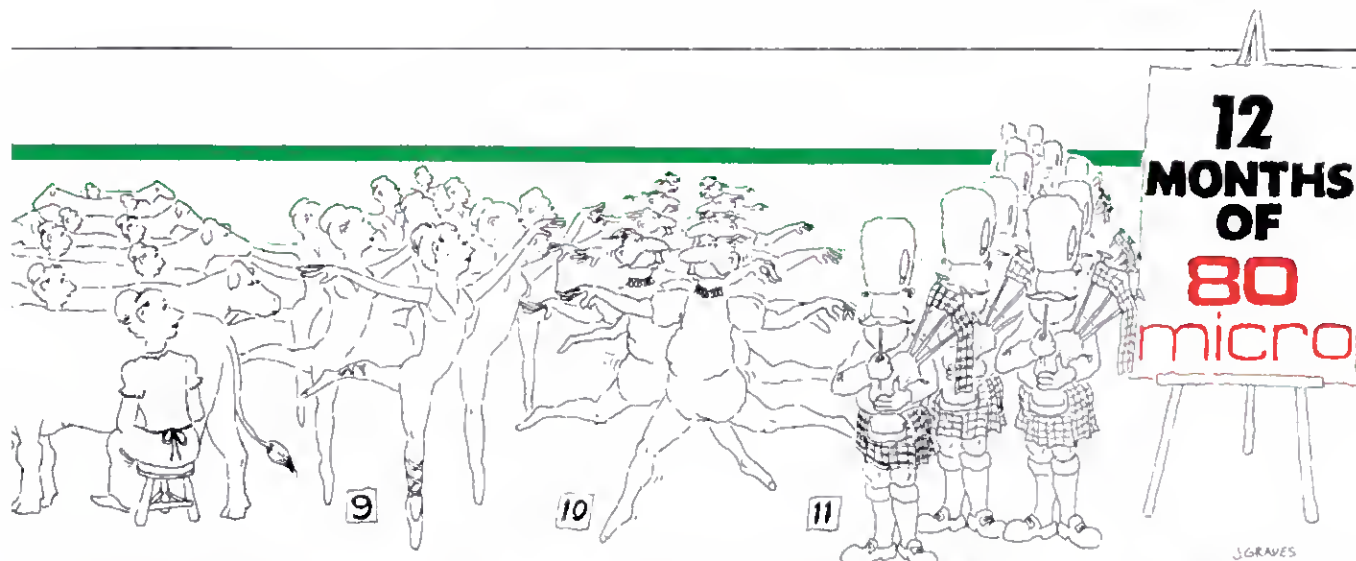
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tion, to modify the behavior of the Basic program.

Write+ is a delightful program that lets you print out files created through Text. You can arrange to skip perforations, pause between pages for printing on single sheets, and print multiple copies, double- or triple-spaced output, and page headers and footers with the time and date.

The two types of word processors in the world are those that display on the screen exactly what will appear on the printed page, and those that display raw text on the screen and format the text for printing after you complete all your editing. Write+ is the latter type.

For instance, text that is double-spaced on paper appears single-spaced on the screen. Given that the Model 100 screen is much smaller than most CRTs, that is the best choice.

The Model 100 input and output routines are largely device-independent. Any of several devices with appropriate file names can be the object of Open and Close statements. These include RAM, LCD, CAS, MDM, LPT, and COM.

Write+ takes advantage of this. You can take the output that would usually go to the printer and route it to RAM for later editing or to COM for printing on a serial printer. Similarly, though you usually use Write+ to print files put in RAM by means of Text, it can take its input from any other device, such as a file on cassette.

Write+ is easy to use. You can easily print out text files created long ago with Text, skipping perforations, within 20 minutes of opening the Businesspak+ package.

Write+ uses simulated form feeds. When the time comes to skip forward to the top of the next page, the program uses individual line feed commands with an ASCII value of 10. Many printers, however, are capable of responding to a form feed character with an ASCII value of 12.

This accomplishes motion to the top of the next page much more quickly and quietly than a series of line feeds. It would have been nice if W+SPEC let the user select simulated or actual form feeds.

I have, however, determined a way to modify Write+ so that form feeds accomplish the perforation skip and blank page skips. The new lines appear in Program Listing 1.

EXPNS+ is an aid to travelers who must keep an expense record. Though it's described as a spreadsheet program, it is quite limited in capability. The program sets up an array of numbers, drawing up totals for up to 18 rows and 12 columns.

It does not let the user define relationships between and among different locations in the array, but merely adds up each row and column. Thus EXPNS+ is far less versatile than programs like VisiCalc.

*"EXPNS+ is an aid
to travelers
who must keep
an expense record."*

You can store the numerical values in the array in RAM, then transfer them to and from other devices, such as a cassette. You can use the RAM file as input for the Graph+ program or merge it into a word processing file using Text.

Put+ is a simple data entry program. Given a user-defined P+SPEC file, the program accepts user keyboard entries and assembles uniform-length ASCII records composed of fields of user-determined fixed lengths. The program defines the fields within records in a SPEC file that the user creates. When you run the Put+ program again later, the program adds new records to the end of the existing file.

During keyboard entry of data, you go from one field to the next by means of the down-arrow key, and store the record by pushing the enter key. I found that to be awkward, and often pressed the enter key at the end of a line when the software expects the down-arrow key.

Also, when filling in, for example, a three-character field with a three-digit entry, I often found that Put+ jumped ahead to the next record when it should have simply accepted text for the next field in the same record. PCSCG has since corrected both of these awkward situations in Put+.

Given the SPEC file and assuming you have fewer than 256 records, the Sort+ program then sorts the records as discussed below. You can also easily search the records using SCHEDL and ADDRSS (or even Text).



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However, when you display the file on the screen or print it on the printer, it tends to look irregular. This occurs because the program runs adjacent fields together without spaces to separate them, and because both the screen display and print routines wraparound entire words at the end of the line rather than cut them off. According to PCSG, a new program called Data+ (\$59.95) is available that allows variable-format displays and listings.

The Sort+ program allows sorting of up to 255 uniform-length ASCII records according to any selected constant-length field in the records. It's easiest to use Sort+ with records created through Put+, but you can use Sort+ on other files too, as long as the records and fields within records are of uniform length. Simply create a Put+ specification file to match the fields in the file you want sorted.

Also, when Sort+ reads in the file it will sort, it puts any lines of nonstandard length at the beginning of the output file. This is handy for two reasons: You can leave explanatory material, such as a heading or verbal summary, at the beginning of the file and it isn't disrupted by the sorting process.

Program	K to load	Free K to run
Write+	4.4	2
EXPNS+	7.0	5
Put+	2.8	1
Sort+	2.6	4+
Telex+	3.9	1
Graph+	6.0	7

Table 1. Program sizes.

If you mistakenly include a line of inconsistent length in the file, it appears at the beginning as well. This brings the line to your attention so you can correct it.

The sort is a simple sort in ASCII order. The documentation claims that you can sort 255 records in 15 to 20 seconds. One file I sorted actually required just over two minutes. I attribute this to the fact that Sort+ swaps entire records whenever a comparison so indicates.

This isn't really a drawback, but a consequence of the Model 100's limited memory. On a larger machine, it would be possible to sort more efficiently by extracting and sorting key fields, and by swapping the entire records only when the key fields are in order.

PCSG has also released another program, Sort2+, that does a few things Sort+ cannot. For example, it sorts true numeric data so that 6 comes out above 10 in order.

Or you can set Sort2+ to sort with the uppercase flag bit suppressed: The result is that the program treats upper- and lowercase letters equally in the sorting process. Finally, it performs the sort directly on the RAM file, rather than by reading the file into the Basic program area. Sort2+ needs less free RAM than Sort+.

Telex+ helps you send telexes, mailgrams, and the like from text files you've previously typed in and saved. To use Telex+, you must open an account with Action Telex, a company based in Dallas that accepts messages through a modem over phone lines and sends them out via the Western Union telex network.

This requires payment of a \$150 annual registration fee and a moderate us-

age charge. The advertisements I've seen for Businesspak+ don't make this point very clear. The Businesspak+ documentation describes a free trial arrangement whereby you can send three free telexes or mailgrams.

I tried this by calling the phone number in the manual and supplying the requested information. I was told that Action Telex would contact me with an identification code for the free trial. Three weeks and three more phone calls passed before I finally got a code.

When I tried it out, the program indicated that Action Telex had accepted my mailgram and two telexes for delivery, but none of them reached their destination. When the local office finally called with another code, I had better luck. The mailgram got through all right, but the telex was delayed eight hours.

Though the documentation said nothing on the matter, I found I had to precede the destination telex number with a zero. After that I had no trouble with Action Telex.

I also had some problems with the Telex+ program itself. The Model 100 has a built-in modem with provisions for acoustic coupling and direct-connect autodial operation. However, one constant feature of the program is that it tries to dial the phone number for access to the Action Telex computer whenever you run it.

If you are using the acoustic coupler, this doesn't hurt anything, just wastes time. But if you are trying to dial the access number manually for MCI access or to get through a Touch-Tone-only switchboard, the dialing routine frustrates your efforts by hanging up the phone for a second before listening for the carrier tone.

It would be helpful if PCSG modified Telex+ to allow the equivalent of the Term key in TELCOM, and thus bypassed the autodialing routine. One remedy is to use a duplex jack instead of the silver phone cord. Plug in both the phone and beige cable. Do not hang up the phone until the Model 100 detects the carrier.

Graph+ lets you prepare graphs based on numerical and text information typed in using the EXPNS+ program. The graphs can be pie, bar, and line charts.

Since Graph+ takes its input only from EXPNS+, and since EXPNS+

For Version 1.3:

```
1400 IF FF%<>0 THEN PRINT#2,MID$(LFS,1,2*(BM%+LC%)):HF%=2:GOSUB 1550
1405 PRINT#2,CHR$(12);:IF BL%-PP%>0 AND PG%<PE% THEN 1490
1410 IF CN%<NC% THEN CLOSE:BL%=160:PP%=0:GOSUB 1450:GOTO 130 ELSE
PRINT#2,CHR$(12);
```

For Version 2.1:

```
32 IFF%<>0 THEN PRINT#2,LEFT$(LFS,2*(BM+LC)):HF=2:GOSUB 43
33 PRINT#2,CHR$(12);:IF BL-PP>0 AND PG<PE THEN 39
34 IFCN<NCTHEN CLOSE:BL=160:PP=0:GOSUB 37:GOTO 6
ELSE IFFD THEN PRINT#2,CHR$(12);
```

Program Listing 1. Form feed modifications for Write+.

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handles only up to 18 columns, that's the largest number of points you can graph. Thus any line graph is, of necessity, quite bumpy.

The Businesspak + software comes on cassette, all of which you can back up. I found the cassettes themselves to be of high quality and well recorded; I had no load errors after dozens of loads. You must load each program from cassette before use, which takes as long as four minutes.

Documentation and Support

The documentation, totaling some 108 pages, is written under the assumption that the user is already familiar with the connections to the Model 100, has mastered the built-in program Text, and has at least passing familiarity with the other built-in software.

The documentation has no general index, but you don't need one since index tabs for each program allow easy reference to explanatory material. In addition, Write +, perhaps the most complex program, has its own index in the most recently received documentation.

The PCSG telephone number appears prominently on the manuals and instructions. I called several times at various times of the day and night, and always reached cheerful people. Though I had difficulty getting signed up with Action Telex, the frustration was outweighed by the many other times that my questions were answered immediately and correctly.

Each time I called, PCSG asked for the serial number of my software package. I consider this a perfectly reasonable request as it helps protect against

software pirates, but the drawback was that I was immediately identified as a reviewer. Nonetheless, I sense that all purchasers can expect good customer support.

User-Friendliness

The programs are well error-trapped, although occasionally I tripped them up with unusual inputs. For example, each program depends on one or more SPEC files containing file formats, field names, and so on. If the SPEC file is not set up properly, the program using it can go astray. I had particular prob-

terminators. Even that function generates errors; for example, if three characters are requested, and if only two characters are left in the device you'll get an end-of-file error.

The writers of Businesspak + use a machine-code routine of about 166 bytes called from Basic. This routine goes to the input device and gets the next printable line of characters up to the next carriage return or space.

One drawback of the machine-code routine is that if no space occurs within the next 160 characters, the routine only returns a single character. I discovered this when I attempted to list a Basic program with all the spaces removed. Some of the long lines in the file printed out in a column, one character at a time. I had to go back to the Basic program and insert spaces to make listing through Write + possible.

The programs are written in Basic rather than machine code. The advantage of Basic is that the user can easily modify the code, perhaps to customize it for a different printer or add a feature. The disadvantage is that machine code can be faster and more compact. For most of the programs, such as Write + and Put +, the execution, printing, and keyboard delays are not even perceptible.

Even if you have the maximum RAM available to the Model 100, 32K, you don't have enough room to leave all the Businesspak + programs in RAM all the time. The instruction book suggests that you purge the programs when you are done and reload them later from tape. Personally, I find Write + so handy that I have left it in RAM continuously since first loading it.

The advertising and the manual I initially received are silent on the required RAM. Most of the routines fit in less than 4K, leaving a little work space for an 8K user (see Table 1). No serious user should consider less than 24K, and I recommend getting a full 32K.

Businesspak + provides a good package of routines for the Model 100 owner. They are easy to learn and use. The graphing program works only on the Radio Shack DMP-100, and the telex program involves a further expenditure of \$150 per year. But the word processing, sorting, text entry, and simple spreadsheet programs are general in their scope and utility. I recommend them. ■

*"Businesspak + provides
a good package
of routines for
the Model 100 owner.
They are easy
to learn and use."*

lems coming up with a P+SPEC file suitable for use with Put +.

One problem anyone faces who writes text-handling programs for the Model 100 is that RAM files can have arbitrarily long records. A Line Input or Input that goes to a string variable can cause an OS (out of string space) error that's hard to protect against.

To alleviate this problem, Microsoft provided the INPUT\$ function, which gets a specified number of characters from an input device regardless of line



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Assembly Language Made Simple—Part I

by Hardin Brothers

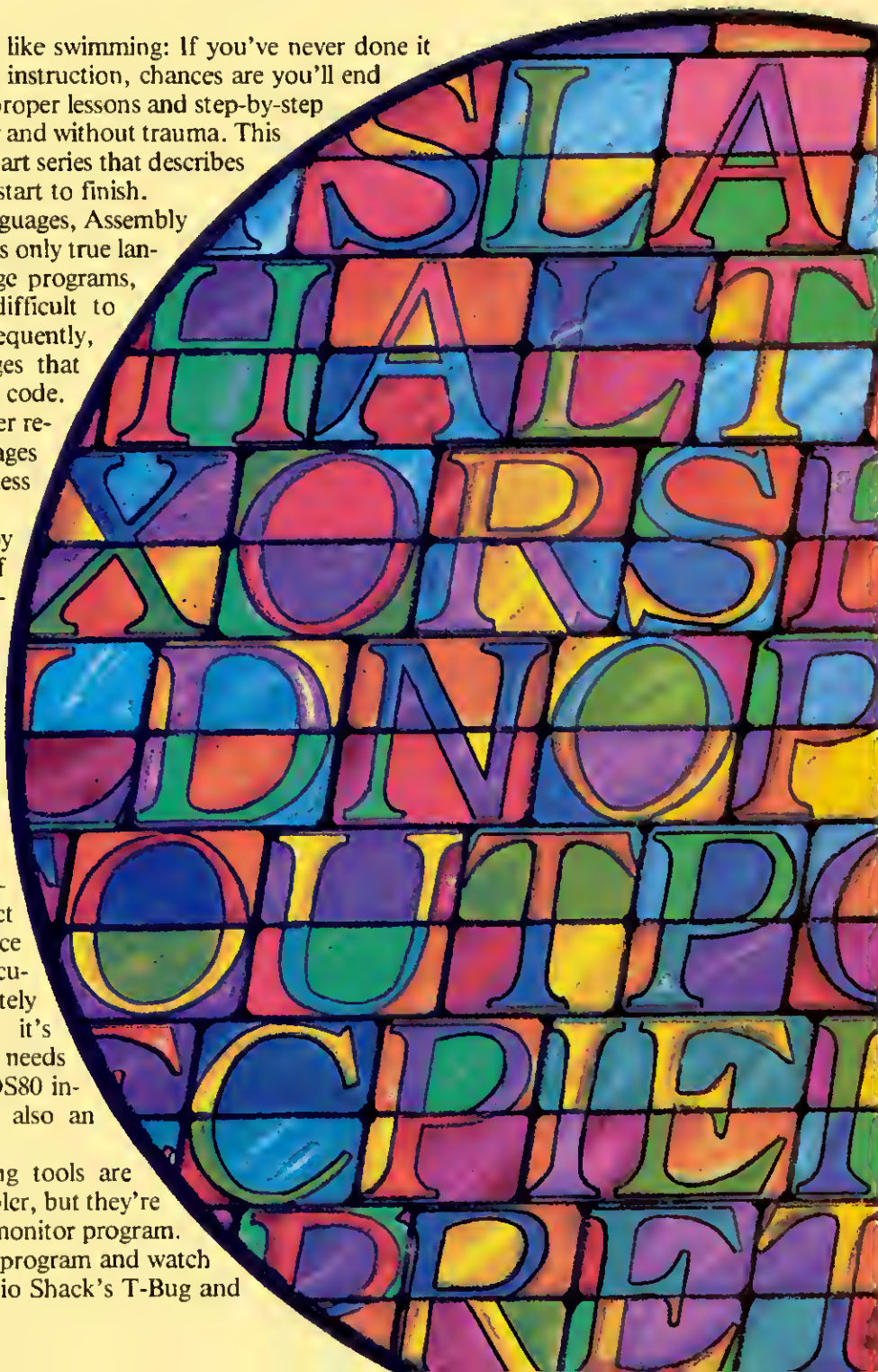
Asssembly-language programming is like swimming: If you've never done it before and plunge in without any instruction, chances are you'll end up over your head. However, with the proper lessons and step-by-step guidelines, you'll learn the skill smoothly and without trauma. This article is the first in a consecutive three-part series that describes Assembly-language programming from start to finish.

Like Basic and all other computer languages, Assembly language is a variation on the computer's only true language, machine code. Machine-language programs, comprising only 1's and zeros, are difficult to write and prone to typing errors. Consequently, programmers developed other languages that use mnemonic code to replace machine code. Although easier to work with, the further removed from machine code these languages are, the slower they execute and the less powerful they are.

Assembly language provides a happy medium. It combines the advantages of simple code with the power of a language that closely resembles machine code. As a result, an Assembly-language program runs faster and provides more computational power than, say, a Basic program.

Before you begin to write in Assembly language, you need the proper tools. Most important is a program called an editor/assembler. If you don't own one, the Radio Shack Series 1 Editor/Assembler is a good choice to get you started. It's powerful for the price (\$30 to \$35), comes with excellent documentation, and while it doesn't completely satisfy an experienced programmer, it's powerful enough to satisfy all your needs until you become an expert. NEWDOS80 includes Apparat's EDTASM module, also an excellent first assembler.

Several other beginner programming tools are helpful in addition to the editor/assembler, but they're not mandatory. Most useful is a good monitor program. Monitors let you single-step through a program and watch the execution of each instruction. Radio Shack's T-Bug and



Here's your first lesson in Assembly-language programming. This article describes how the Z80 chip processes Assembly instructions.

Debug, as well as any DOS Debug, can start you off, but more powerful monitors are available.

Other useful tools are a disassembler program, Nanos Systems Corp.'s Z80 reference card, a printer for listings (invaluable for complex debugging), several reference books, and a disk system to simplify loading, saving, and assembling programs. These are all extras that make Assembly-language programming easier; at first, all you need is an editor/assembler.

The Z80

The heart of your Model I, II, III, or 4 is a Z80 microprocessor chip (or Z80A, the same thing but faster). Though this is one of the most advanced 8-bit microprocessors made, with 22 registers and a strong instruction set, it still has a very limited repertoire of capabilities.

The Z80 can get a value from memory, put a value into memory, move values around in between its internal registers, add and subtract two values, perform simple logical manipulations (AND, OR, and Exclusive-Or), report some information about the results of its operations, keep track of where to find its next instruction, and manipulate a simple data structure called a stack. It can't multiply or divide, directly print to the screen or printer, or do most of the things your computer does in Basic.

Your job as an Assembly-language programmer is to utilize the simple abilities of the Z80 chip to develop a complex program, usually complete with input from keyboard, tape, or disk and output to tape, disk, screen, or printer. To do so, learn to think in terms of the Z80's capabilities, which means you have to break each operation into specific, small steps. If you can train yourself to analyze and build programs in these small steps, you're well on your way to becoming an Assembly-language programmer.

Assembly and Machine Language

The only instructions the Z80 understands are sequences of 5-volt and zero-volt electrical impulses. Generally we refer to those impulses as 1's and zeros.

For example, the sequence of impulses represented as 11001011 00100111 makes the Z80 copy a specific single bit from one place inside itself to another. Because se-

quences of 1's and zeros look like a binary number, programmers often think of them as such, and translate them into hexadecimal or, rarely, decimal numbers. The above instruction would thus appear as CBH 47H in hexadecimal notation, 203 071 in decimal. When you write programs by loading such values directly into memory, either with POKEs or by using a monitor program, you program in the Z80 native tongue, machine language.

However, the Z80 recognizes almost 700 such instructions. Except in unusual circumstances, it's a waste of time for a programmer to look up each instruction in a table and enter its special sequence directly into memory. That's why the first computer language ever developed was "Assembler." Using an assembler, you can write instructions using mnemonic (memory aids), 2- to 4-letter abbreviations of program instructions. You can write the binary instruction above as BIT 0,A which, while still far removed from English, is much easier to remember and understand.

The assembler changes the mnemonic into the appropriate bit sequence by looking it up in a table. The list of mnemonic instructions, which you write, is called a source code; the list of machine instructions, which the assembler writes from the source code, is the object code. The Z80 chip cannot act directly on source code instructions, so the translation into bit sequences is necessary before you can run your program.

Unlike Basic, assemblers are not interactive. You must write the source code, assemble it into machine language (which you save on either tape or disk), then load the object code back into the computer to run it. If a bug occurs in the program (and one almost always does), you must then reload the assembler program, reload your source code, correct the source code, save your source code back to tape or disk, assemble the program again on tape or disk, load the new object code back into memory, and run it again.

Virtually all assemblers come with an editor, a separate but related program that helps you write and correct source code. The editor is a simple, line-oriented text processor that includes the ability to number lines of source code and to find lines by reference to their numbers.

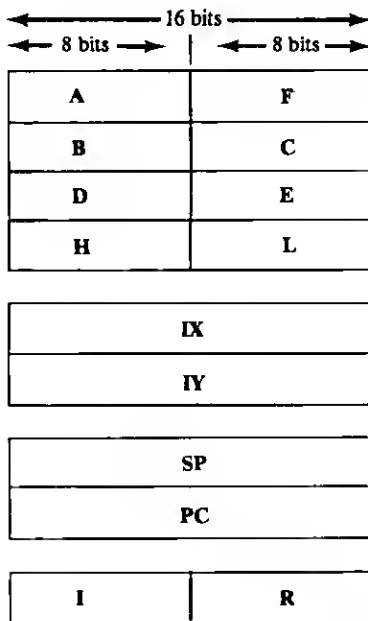


Figure 1. The Z80 registers.

Whenever you use an editor/assembler package to write a program, you must go through a four-step process:

- Use the editor to write the source code.
- Save the source code to tape or disk.
- Assemble the source code into object code and save the object code to tape or disk.
- Leave the editor/assembler program, return to either Level II Basic or DOS, load in the object code form of the program, and run it.

The finished program probably loads as a SYSTEM program, if it's on tape, or as a /CMD program if it's on disk.

Memory and Registers

Your computer provides several different types of memory. Basic resides in ROM, the keyboard and screen each have specially dedicated random-access memory (RAM), and programs and data use between 16K and 48K (on the Models I and III) of general-purpose RAM. Each byte of memory has a unique address which the Z80 uses to find stored values and to place values in the correct locations.

Like program instructions, memory addresses are nothing but unique sequences of electronic impulses, but it is easier to think of them in terms of hexadecimal or decimal numbers. You can remember memory addresses more easily in hexadecimal once you become familiar with that numbering system.

In Models I and III, ROM occupies addresses from 0000 hexadecimal (hex)

to 37FF hex, the keyboard from 3800 hex to 3BFF hex, the video screen from 3C00 hex to 3FFF hex, and general memory from 4000 hex to 7FFF hex, BFFF hex, or FFFF hex depending on the amount of RAM in your system. All of the programs I include with this article run with any size RAM (except 4K) for a Model I, III, or 4 (in the Model III mode).

You may notice that memory holds both program instructions and data, and wonder how the Z80 distinguishes the two. It doesn't. As far as the Z80 is concerned, no difference exists between the two; you and your program decide which parts of memory hold instructions and which hold data. However, if you make a mistake and allow the Z80 to operate on data as if it were instructions, you face the infamous "silent death"—either a locked up computer

or a spontaneous reboot.

The Z80 contains 208 bits of memory organized into registers (see Fig. 1). Each register is either 8 or 16 bits wide—that is, each holds either 8 or 16 bits of information. As a programmer, you manipulate the values held in these registers, and copy information from the registers to RAM and vice versa.

The A register, which holds 8 bits, is the accumulator. It's a general pipeline for moving data into and out of the Z80 chip, and also aids in almost all of the arithmetic and logical operations the Z80 performs.

The individual bits of a second register, called the F or flag register, holds information about the results of various internal operations. The Z80 uses these flags to perform conditional branches (similar to the Basic If...Then command).

B, C, D, E, H, and L are all general-purpose 8-bit registers that hold temporary data and operands for arithmetic and logical operations. You can also use these registers in pairs: BC, DE, and HL. Each pair holds 16 bits and can hold data addresses in memory, or large values used in some arithmetic functions.

The HL register pair also has a special function. Whenever the Z80 performs 16-bit arithmetic operations, the HL register pair becomes an accumulator and holds the results of the calculations. Using any register pair as two 8-bit or one 16-bit register is entirely up to you, and you can change their function at any time.

Two 16-bit index registers exist, IX and IY. They almost always hold addresses of data tables in memory, and make accessing that much easier.

SP, the stack pointer, is a special-purpose register that holds the address of (points to) a data table called the stack. Stack operations let the Z80 return to the appropriate location after

```

00100 ;*****
00110 ;
00120 ;   The First Program --
00130 ;
00140 ;   Print "HI" in the upper-
00150 ;   left corner of the screen
00160 ;
00170 ;*****
00180 ;
00190 ;       ORG       7000H           ;Define beg. of prog.
00200 ;
00210 ;START  LD       A,48H           ;48H is ASCII value of H
00220 ;       LD       (3C00H),A       ; and put it on screen
00230 ;       LD       A,49H           ;49H is ASCII value of I
00240 ;       LD       (3C01H),A       ; and put it on screen
00250 ;       LOOP     JP        LOOP   ;Loop forever
00260 ;
00270 ;       END       START
00280 ;

```

Program Listing 1. Assembly-Language Lesson 1.

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Editor/Assembler

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it completes a subroutine, simplify saving data from registers temporarily, and allow transfer of 16 bits of information from one register pair to another.

The program counter, register PC, always holds the address of the next program instruction. The Z80 uses the PC register to keep its place in the program while it carries out an instruction.

A', F', B', C', D', E', H', and L' (the prime set) are a second set of general-purpose registers. If you give the correct instructions to the Z80, it saves the regular general registers (A to L) and the prime set becomes active. A later exchange instruction switches the first set of registers back into active service. It's up to the program (and programmer) to keep track of which set is in use at any given time—the Z80 considers the inactive set the prime set.

Finally, there are two 8-bit registers, I and R, that programmers rarely use. The R register holds the address of the next bank of memory that needs refreshing (a kind of electronic tickling to stay awake). The Z80 handles the memory refresh chores automatically. The I register is useful for some interrupt processing, but the Models I and III don't include the hardware necessary to use it.

A First Program

The best way to understand Assembly-language programming is to start programming. Because every editor/ assembler package includes its own unique editor instructions, I will not give explicit instructions on using the editor portion of your editor/assembler. Load the program and run it, then use the documentation to experiment with the editor until you are comfortable with its commands. You probably use a command like I to start entering text on numbered lines, a Break to return to the function prompt, a P to list what you have written, and so on.

Your first Basic program was probably something like

```
10 PRINT "HI"
```

so I'll start you with a similar Assembly-language program (see Program Listing 1). Even though this is a simple, short program, there is much to learn from it. The first nine lines, 100-180, are all remarks and the assembler ignores them. In most assembler formats, a semicolon precedes all remarks.

It is wise to liberally include remark statements in your source code programs—the remarks don't take up memory space in your completed machine-language program and they help

you understand program logic several weeks later.

After the remark lines, everything in the program falls into four neat columns. The first column, or field, contains a five-digit line number as supplied by the editor. As I explained earlier, these numbers are used only by the editor and ignored by the assembler. They help you find the correct line to edit and the right place to insert new lines. Just as in Basic, it is normal in Assembly language to increment lines by 10 so you can insert lines later. Also, your editor probably includes a simple renumbering facility.

The second column contains labels,

each of which can contain one to six alphanumeric characters. Labels can represent either values (as I show in the next program) or the addresses. The labels in this program, Start and Loop, represent the addresses of the instructions that follow them.

The third column contains either the mnemonics for the machine-code instructions or pseudo-ops—direct instructions to the assembler program that don't get translated into machine instructions. Simple assemblers provide only a handful of pseudo-ops that are easy to understand and use.

The fourth column contains the operands for each instruction. Each mne-

Making Sense of Those Crazy Numbers

by Amee Eisenberg
80 Micro Technical Editor

The Decimal System

For those of us with 10 fingers, a decimal number system (based on units of 10) has always made intrinsic sense. You start at your thumb and keep counting until you run out of fingers. Then you make a mark to signify one group of 10 and start at your thumb again. Things are counted in groups of 10s plus any left-over 1's.

We write numbers using a place value system, placing units, or 1's, furthest to the right in a number. The next place holds the 10s, and the next the 10 times 10s, or 100s. Reading from right to left, the value of the place increases by a multiple of the base. Thus, 1, 10, and 100 signify one unit, 10 units, and 10 times 10, or 100, units respectively. You can represent this as follows:

```
Y Y Y    (* 1)
          (* 10)
          (* 100)
```

The Binary System

Your computer is based on a binary numbering system; that is, it uses a two-unit counting system. It counts with electrical impulses that are either off or on, which we represent numerically as 0 and 1. It also uses a place value system to keep

track of larger numbers.

In a binary, or base 2, numbering system, the places hold multiples of 2. So the first place represents units, the next 2's, the next 4's. Thus, 1, 10, and 100 signify 1 unit, 2 units, and 2 times 2, or 4, units respectively. This is represented as:

```
Y Y Y    (* 1)
          (* 2)
          (* 4)
```

Binary becomes ungainly for humans as the numbers get larger. For instance, the number 136 decimal is written 10001000 in binary. That is, there are no 1's, no 2's, no 4's, one 8, no 16s, no 32s, no 64s, and one 128. Adding the one 8 and the one 128 results in the decimal equivalent, 136, as below:

1 0 0 0 1 0 0 0	0 (* 1)
	0 (* 2)
	0 (* 4)
	8 (* 8)
	0 (* 16)
	0 (* 32)
	0 (* 64)
	128 (* 128)
	—
	136 decimal

Since humans count in decimal and computers in binary, a compromise counting system is necessary to make conversations between humans and computers a little simpler.

monic requires that zero, one, or two operands follow it. In most cases, the number of operands is obvious—you can't ask the Z80 to load (LD) a value unless it knows where the value is coming from and where it is going. So, two operands always follow the Load command.

Finally, Assembly code reserves the last column of each line for remarks. You can quickly learn to write cogent remarks that fit on the same screen line as the rest of the instructions and produce clean, easy-to-read source code.

Refer back to Listing 1. Lines 100-180 are remarks ignored by the assembler. Line 190 starts with the

pseudo-op ORG, which defines the starting address of the program so the assembler can calculate addresses of each of the instructions.

Notice that the program's address, 7000H, is a hexadecimal number followed by the letter H. The same address, in decimal, is 28672. Unless a suffix of H or B follows a number, the assembler assumes that number is in decimal format. However, the assembler accepts a suffix of D to indicate a decimal number. Get into the habit of adding a base suffix to the end of every number you use in a source code, regardless of its base; it makes debugging much easier.

Enter the base 16, or hexadecimal, numbering system.

The Hexadecimal System

Hexadecimal (usually abbreviated hex), is just like decimal if you have 16 fingers. To count in hex, you say 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F. A is equivalent to 10 decimal, B to 11 decimal, C to 12, D to 13, E to 14, and F to 15. Ten hex is equal to 16 decimal because, just like decimal and binary, hex uses a place value system to represent numbers. Ten hex means that there are no units and one 16:

Y Y (*1)
(*16)

When you write a hexadecimal number, we append the uppercase letter H to it to avoid confusing it with binary or decimal. Additionally, we write the numbers A through F as 0AH, 0BH, 0CH, etc., the zero eliminating confusing the numeral with a letter.

To understand why hex is convenient for the computer, you need to think about how the computer stores information. The Z80 microprocessor uses 8-bit logic. A bit is an electronic signal that's either on or off (binary, remember?).

A group of 8 bits of information clustered together is called a byte. A single hex numeral can represent half-bytes, or nibbles, consisting of 4 bits because the greatest value a four-digit binary number represents is 16 decimal. Remember, 1000 in binary is 10 in hex and 16 in decimal. So two hexadecimal digits can represent any 8-bit value (a byte).

It's easy to convert a binary byte to a hexadecimal byte. Take the number 10001000 binary again. The first step is to break the byte into its component nibbles, 1000 and 1000. Then convert each nibble to hex:

1 0 0 0	0 (*1)	1 0 0 0	0 (*1)
	0 (*2)		0 (*2)
	0 (*4)		0 (*4)
	8 (1*8)		8 (1*8)
	8H		8H = 88H

Therefore, 10001000 binary is 88 hex. Check this by converting both binary and hex values back to decimal. Earlier I said that 10001000 binary is 136 decimal. 88H means 8 units plus 8 sixteens (or 128) which equals 136 decimal.

Try another binary-to-hex conversion, this time with 10011110. Break it into two nibbles: 1001 and 1110. Convert each nibble:

1 0 0 1	1 (1*1)	1 1 1 0	0 (*1)
	0 (*2)		2 (1*2)
	0 (*4)		4 (1*4)
	8 (1*8)		8 (1*8)
	9		E (14 decimal)
			= 9EH

So, 10011110 is 9E hex. If you check this by converting to decimal you find 10011110 equals (128 + 16 + 8 + 4 + 2) or 158, and 9EH equals (9 × 16 + 14), also 158.

Working with binary and hex becomes easier as you do more of it. And learning these other number bases is necessary if you want to speak in your computer's native tongue. ■

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```

00100 ;*****
00110 ;*
00120 ;*   The Second Program --   *
00130 ;*
00140 ;*   Fill the screen with 'HI' *
00150 ;*
00160 ;*****
00170 ;
00180 VIDEO EQU 3C00H ;3C00H = top of screen
00190 ;
00200 ORG 7000H
00210 ;
00220 START LD HL,VIDEO ;HL==> Top of screen
00230 LD BC,4000H ;BC=length of screen
00240 LOOP1 LD A,'H' ;Get first character
00250 LD (HL),A ;Put it on screen
00260 INC HL ;HL==> next screen pos'n
00270 DEC BC ;BC=number of pos'ns left
00280 LD A,'I' ;Get next character
00290 LD (HL),A ;Put it on screen
00300 INC HL ;HL==> next pos'n
00310 DEC BC ;one less pos'n left
00320 LD A,H ;Get MSB of count
00330 OR C ;Merge with LSB of count
00340 JP NZ,LOOP1 ;Loop if pos'ns left
00350 JP LOOP2 ;Then loop forever
00360 ;
00370 END START
00380 ;

```

Program Listing 2. Assembly-Language Lesson 2.

Line 210 is the first line of actual instruction. It has the label *Start*, which the assembler sets equal to the address of the instruction (7000 hex). This instruction tells the computer to load (LD) the A register with 48 hex, the ASCII value of the character H.

Line 220 instructs the Z80 to take the current value in the A register, and place it in memory at address 3C00 hex. Remember that the screen memory occupies addresses from 3C00 hex to 3FFF hex. Therefore, this instruction causes the Z80 to place the value 48 hex in the first location of screen memory. The computer's screen electronics then print an H in the upper left-hand corner of the screen.

Four things in line 220 require special attention. First, notice the parentheses placed around the screen address. They are necessary to indicate to the assembler that 3C00 hex is an address, not a value you want manipulated. The instruction is best read as "Load the contents of register A into the memory location represented by the value 3C00 hex."

Second, notice that getting the H to the screen requires two instructions. The first instruction reads the H from memory and the second stores it to a different place in memory. In general, the Z80 cannot simply move data from one memory location to another. It only moves data to or from the registers in the chip. (Some instructions avoid this restriction, however.)

Third, it is important to realize that this instruction doesn't change the contents of register A. It copies the contents to location 3C00 hex, but A is not empty. An LD instruction never changes the

value that it moves; it only transfers that value to a new place.

Fourth, notice the order of the two operands of each LD instruction. The first operand receives the value transferred from the second. If you read line 220 as "Load 3C00H from A" you can remember the correct order of operands.

Lines 230 and 240 are now clear. They load the A register with the ASCII value of I and place that value at the next screen location. When the computer executes the instruction in line 240, it prints HI in the top corner of the screen.

Line 250 introduces a new instruction, the Jump (JP) instruction. It tells the Z80 to take its next instruction from a new place in memory (like Basic's GOTO). Notice that the line gives the symbol *LOOP*, and the instruction says "Jump to *LOOP*." This instruction produces a tight, endless loop similar to the Basic instruction "50 GOTO 50." The computer seems to lock up and there's no way to regain control except by pushing the reset button. This instruction is necessary to stop the Z80 from wandering off and trying to execute whatever it finds scattered through memory. Every program must come to some specific end, either with a loop or a return to Basic or DOS.

The last line of Listing 1 uses the pseudo-op *END* for two purposes. First, the assembler needs to know the end point of the program. Every source code must have *END* in its last line. Second, if the address of the beginning of the program follows *END*, the assembler includes that information on disk or tape so the program runs automatically. *Start* is the label for the be-

ginning of this short program and, because it already equals 7000 hex, it tells the assembler that the program starts at that address.

Before you read further, try to enter and assemble the program in Listing 1. Use the Insert command to get automatic line numbering, and copy the program exactly (you may leave out the remarks if you wish), using the right-arrow key to tab between columns on the screen. Then return to the prompt.

When you're ready to assemble the program, first try a test assembly by assembling the program with no output. The command you give to the assembler is probably *A,NO*, or *A/NO* which asks it to assemble without output. If you enter the program correctly, the assembler displays 00000 Errors. That is the assembler's method of saying that each line has correct syntax; obviously, the assembler doesn't know whether your program does what you want it to.

Save the source code to either tape or disk. (If you make a logic error in your program, you want to correct the source code, not write it all over.) Assemble the program to tape or disk. In both cases, give the program a name—on tape the names can be anything you wish; on disk, write the source code with a */SRC* or */ASM* extension and the program with a */CMD* extension to make it run directly. Finally, use *SYSTEM* or *DOS* to load and run your program. "HI" should appear in the upper left corner of the screen. Your computer is in an endless loop, so press the Reset button to regain control.

If all goes well, reload the editor/assembler and the source code and try to modify it—perhaps have the program print your name on the screen. Experiment with different messages and different screen locations—it is the only way to learn Assembly language.

Modifying a Program

I know Listing 1 isn't an exciting program, but your first Basic program probably wasn't much fun either. Here I add a few bells and whistles, as well as some new concepts.

Program Listing 2 fills the entire screen with the letters HI. It also introduces several new programming techniques, the first of which is in line 180. The *EQU* pseudo-op sets the label *Video* equal to the value 3C00 hex; instead of having to remember a value each time you use it in a program, you can give it an easy-to-remember label.

Line 200 looks familiar. Line 220 tells the computer to load the value of *Video* into the HL register pair. In this pro-



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gram, HL points to, or holds, the address of the current video position in order to simplify the program.

Line 230 loads the BC register pair with the value 400 hex (which equals 1,024). This program uses BC as a byte counter; 400 hex equals the length of the screen, and when BC is zero, the screen is full. Using a byte counter is similar to using a For...Next loop in Basic.

Line 240 loads the A register with the ASCII value for H. By placing the H inside a set of single quotation marks, you tell the assembler to translate the letter into its ASCII equivalent—you don't have to look it up in a table. Line 250 loads the value in the A register into the memory location to which HL points. Notice that parentheses enclose the HL

*"The screen
should fill with
the word HI."*

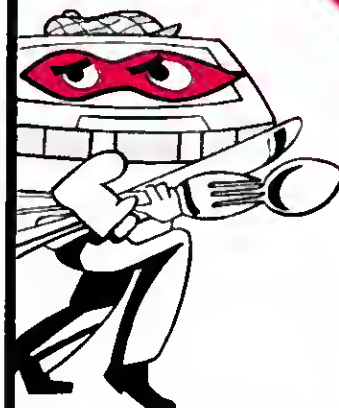
just like the addresses in the last program, which tells the Z80 to treat the current HL value as a memory address.

Line 260 increments (increases by 1) HL so it points at the next memory location and line 270 decrements (decreases by 1) BC so it holds the number of screen positions remaining. Lines 280-310 repeat the whole process for the letter I.

Lines 320 and 330 test the value in BC to see if it is zero yet, which means the screen is full. First, the program copies the value in the B register into the A register. Then it ORs the value in C with the current value in A. If both B and C are zero, the result of the OR is zero, and the program sets the zero flag in the F register. Otherwise, the result is some other value and the F register flag indicates Not Zero.

Line 340 uses the results of the OR to decide whether or not to repeat loop I. It tells the Z80 to jump only if the F register shows Not Zero. If the flag indicates a zero result of the OR in the previous instruction, the program ignores the Jump command. The jump continues until the BC register pair decrements to zero. Then line 350 performs an endless-loop jump.

Notice that the instructions from lines 240-340 do not depend on any particular values in HL or BC. Whatever its current value, HL points to the current address on the screen. The program in-



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```

00100 ;*****
00110 ;
00120 ;   The Third Program --
00130 ;
00140 ;   Fill the screen with a
00150 ;   simple message
00160 ;
00170 ;*****
00180 ;
00190 ;
00200 VIDEO EQU 3C98H ;Address of screen top
00210 ;
00220 ORG 7000H ;Beginning of program
00230 ;
00240 ;First, clear the screen
00250 ;
00260 CLEAR LD HL,VIDEO ;HL==> screen top
00270 LD BC,480H ;BC = Length of screen
00280 CLD LD (HL), ' ' ;ASCII Space to screen
00290 INC HL ;HL==> next screen pos'n
00300 DEC BC ;Decrease count
00310 LD A,B ;Get LSB of Count
00320 OR C ;Merge LSB of count
00330 JP NZ,CLD ;Loop back until BC=0
00340 ;
00350 ;Now that screen is clear, display message
00360 ;
00370 PRINT LD HL,VIDEO ;HL==> screen top
00380 LD DE,MESSAG ;DE==> beg. of message
00390 PRI0 LD A,(DE) ;Get next character
00400 LD (HL),A ;And put it on screen
00410 CALL INCMSC ;Increment & check OE
00420 CALL INCVID ;Increment & check HL
00430 JP NZ,PRI0 ;Loop until screen's full
00440 ;
00450 ;The screen is full, look for a keystroke then start over
00460 ;
00470 KEY LD A,(3BFFH) ;Check the keyboard
00480 OR A ;Set the flags
00490 JP Z,KEY ;Loop until key is down
00500 ;
00510 ;Key is pressed -- wait until it is released
00520 ;
00530 NOKEY LD A,(3BFFH) ;Check the keyboard
00540 OR A ;Set the flags
00550 JP NZ,NOKEY ;Wait until key is up
00560 JP CLEAR ;Then start again
00570 ;
00580 ;Now come the subroutines
00590 ;
00600 ;Increment the message pointer until it points to
00610 ; the end of the message and then reset it to the
00620 ; beginning.
00630 ;
00640 INCMSC INC DE ;DE==> Next pos'n of msg.
00650 LD A,(DE) ;Get the character
00660 CP 0 ;Is it a 0 ?
00670 RET NZ ;Return if not
00680 LD DE,MESSAG ;Else DE==> beg. of msg.
00690 RET ;And then return
00700 ;
00710 ;Increment the video pointer until it is off the screen
00720 ;
00730 INCVID INC HL ;HL==> Next pos'n of vid.
00740 LD A,B ;Get LSB of pointer
00750 CP 40H ;If B=40H, off the screen
00760 RET ;Return for test
00770 ;
00780 ;Now type in the message
00790 ; (You may use any message you wish)
00800 ;
00810 MESSAG DEFB 'How is this for fast?'
00820 DEFB 0 ;Mark end of message
00830 ;
00840 ;That's all, so end the program
00850 ;
00860 END CLEAR ;Include starting address
00870 ;

```

Program Listing 3. Assembly-Language Lesson 3.

crements it after each character prints. BC's current value decrements after the program prints each character. The program continues until BC indicates a full screen. The entire routine depends on the Z80's ability to make a conditional jump in line 340, based on the current status of the zero flag.

Enter, assemble, and run Program Listing 2. Again, you must use the reset button to exit from the program because of the endless loop in line 350. The screen should fill with the word HI. See if you can modify this program be-

ing careful that you don't let the program print off the end of the screen.

More Bells and Whistles

This next program lets you fill the screen with any message you wish. It also allows you to hit any key to clear the screen and print the message again.

Lines 190-270 in Program Listing 3 need no explanation. Notice that the instruction in line 280 loads a character (here, an ASCII space) directly into the memory location to which HL points. This instruction avoids first loading the

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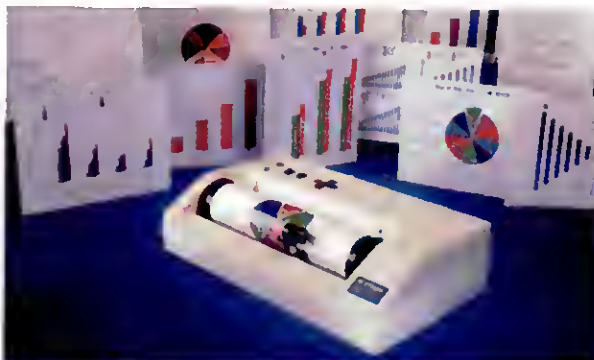
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character into the A register and then back into a new location in memory.

Lines 290-330 are similar to the last program. They increment HL, decrement BC, and test to see if BC equals zero. The entire block of code from lines 260-330 clears the screen by filling it with spaces.

The second block of the program, lines 370-430, prints a message repeatedly until it fills the screen. HL again points to the screen location. Now, however, DE points to the message in line 810. These lines load 1 byte of the

*"Keep experimenting
and you will
soon find that
Assembly language is
as easy as any
other computer language."*

message into the A register in line 390, then put that character into screen memory in line 400.

Lines 410 and 420 introduce a new mnemonic, Call. This instruction is similar to Basic's GOSUB command in that it runs a subroutine. The Z80 saves the address of the next instruction before it runs a subroutine in order to know where to return when it completes the subroutine. Then it jumps to the subroutine and performs those instructions.

The label INCMMSG, which stands for "Increment Message Pointer," defines the first subroutine. The subroutine starts at line 640. This line increments DE, which points to the message. Once incremented, line 650 loads the new character to which it points into A. The command CP zero in line 660 means "Compare the value in A with zero. If the two values are identical, set the flag to Z to indicate a true compare; otherwise set the flag to NZ."

The RET command in line 670 means "Return from this subroutine." Because NZ follows it, it is a conditional return—the computer executes the return only if the flag in the F register indicates Not Zero. Otherwise, in line 680, the program points DE to the beginning of the message again, and then an unconditional return in line 690 sends the Z80 back to the instruction in line 420. The entire subroutine INCMMSG depends on a zero byte at the end

Continued on p. 86

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Beginner's Guide to Assembly-Language Terminology

Simple Glossary

This short glossary should help you learn the most common Assembly-language terms. It's arranged in logical, rather than alphabetical, order.

bit (binary digit)—Though sometimes defined in terms of electronic signals, for present purposes a bit is the smallest amount of information on which the computer acts. It is a single 1 or zero digit and the building block for all computer notation.

byte—A sequence of 8 bits. A byte is generally thought of in terms of its total value. With 8 bits you can express any value between 00000000B and 11111111B. In normal decimal notation that's any value between 0 and 255; in hexadecimal it's any value from 00 hex to 0FF hex.

word—In computer jargon, a word comprises 2 consecutive bytes, or 16 bits, and the computer handles it as a single value. The value of a word can vary from 0 to 65535 (decimal), from 0000 hex to FFFF hex, from 00000000 00000000B to 11111111 11111111B in binary.

address—A one-word (2-byte) value that denotes any byte of memory. Every byte of memory has a unique address, allowing you to find it easily, and find and manipulate its value.

LSB and MSB (least significant byte and most significant byte)—Since every word and every address is composed of 2 bytes, it is useful to have a name for each. The most significant byte is the high-order byte—the one that normally comes first. The other is the least significant byte. For example, in the hexadecimal word 3C42 hex, 3C hex is the most significant byte and 42 hex is the least significant byte. Because of the way the internal Z80 circuitry works, it usually stores 2-byte values in memory backwards, with the LSB before the MSB.

ASCII code—Every possible video character, all video control characters, all graphics characters, and all special (Model III) characters have a unique 1-byte code that the video circuitry uses. The codes for letters and numbers are standard between various computers, but graphics and special characters are not. The ASCII code for the character 1 is 49 or 31 hex or 00110001B (rather than the seemingly obvious value of 1, a complicating fact of life for machine-language programmers).

register and register pair—Registers are special memory inside the Z80 chip. Each is either 1 or 2 bytes in length (8 or 16 bits). A register pair is two 8-bit registers that can work together as a single 16-bit register. There are 22 registers inside the Z80 that your programs can manipulate directly.

ROM (read-only memory)—ROM is unalterable, unchangeable memory inside the computer that holds the resident Level 1 or Level II Basic inside the Models I and III. This memory doesn't change even when you shut off the computer's power, so your computer never "forgets" its knowledge of Basic.

RAM (random-access memory)—Sometimes called read-and-write memory, or program memory, this memory is changeable. The computer uses it to store both programs and data. Unfortunately, it loses all of the information stored in it if the power to your computer is turned off. Unless you did some unusual home-brew modifications, your computer has 4K, 16K, 32K, or 48K bytes of RAM. (K stands for 1000, but in computer usage usually means 1024. 16K, therefore, means 16384 bytes of RAM.)

Status Flags

The F, or flag, register contains 4 commonly used status bits, each of which can direct conditional jumps, calls, and returns.

Z and NZ—The zero flag is the most common. This bit indicates whether the result of a previous operation was zero or some other value. For example, if the result of a subtract or compare operation is zero, the flag shows zero. In source code, the condition Z means zero and NZ means not zero. The zero

Continued on p. 86

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of the message to mark its conclusion.

Line 420 sends the Z80 out to another subroutine, INCVID (Increment the Video Pointer), and passes control to the instructions starting in line 730. First line 730 increments HL. Remember that the video memory is in address from 3C00 hex to 3FFF hex. If HL equals any value in that range, it points at the screen and everything is okay. But when HL equals 4000 hex, it points to the first memory address past the screen. Then H holds the value 40 hex and L holds the value 00 hex.

Line 740 loads the new value in the HL register into the A register for testing. Line 750 compares that value to 40 hex in order to set the F register flags. You might expect the next instruction to be a conditional jump or return, but it isn't. Instead, the subroutine ends with an unconditional return (RET) command. However, the return command doesn't affect the F register, and so the flags remain the same when the Z80 returns to the instruction in line 430, which does contain a conditional instruction. Very often in Assembly language, programs set the condition flags with one instruction but don't use them until several instructions later. Be sure that the instruc-

tions between don't change any of the flags.

Line 430 repeats the print block until the screen fills. Then the program continues with the KEY block starting with line 470. Here, the value in memory location 3BFF hex loads into the A register, which is part of the keyboard memory. This location holds a zero if you're not pressing any key; if it holds any other value, you're holding down at least one key.

Unfortunately, loading a value into the A register doesn't set the condition flags. Therefore, line 480 ORs register A with itself. The value in A doesn't change, but the flags are set to indicate whether its current value is zero. If it is, the conditional jump in line 490 sends the Z80 back to KEY to wait for you to press a key.

After you do so, the program enters the final block of the program, NOKEY. Another loop waits for you to release the key. Then, and only then, the program loops back to the Clear routine at the beginning, clears the screen, and starts all over.

Lines 810 and 820 demonstrate two new pseudo-ops. In line 810, DEFM means "Store the text between the

single quotation marks in memory here." It loads whatever you type in into memory and sets the label MESSAG equal to the address of the first character.

Finally, in line 820, DEFB means "store 1 byte of this value into memory." This instruction stores a byte

Continued from p. 85

flag generally checks the results of arithmetic and logical operations, and tests whether a single register decrement (DEC) results in zero.

C and NC—The carry flag indicates whether a carry or borrow occurred that gives an arithmetically inaccurate answer. For example, if a program adds two 8-bit numbers and produces a 9-bit result, the carry flag holds the 9th bit. Also, rotate and shift instructions use the carry flag extensively.

P and M—The normal arithmetic convention for working with signed numbers uses the highest-order bit to indicate the sign. Therefore 1 indicates a negative number and zero indicates a positive number. The sign flag shows whether the result of a signed arithmetic operation is plus (P) or minus (M). This flag is also of use with compare operations.

PE and PO—The last testable flag has two functions. As a parity flag, it indicates whether a byte has an even or odd number of bits equal to 1. PE then means even parity and PO means odd parity. The same set of flags can also indicate whether there is an overflow from an 8-bit or 16-bit addition or subtraction, in which case PO means no overflow and PE indicates that an overflow has occurred.

N and H—There are two final flags in the Z80, N and H, which you cannot test directly by a program. The computer uses them in a special type of arithmetic called "binary-coded decimal" and generally accesses them by the special DAA instruction.

Logical Operations

The Z80 performs three kinds of logical operations: OR, AND, and XOR. Each has specific uses in Assembly-language programs.

Each logical command works on a single bit position at a time. For ex-

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of zero into memory to mark the end of the message. This is the zero byte that the subroutine INCMSG tests for. Never assume that any memory location holds some specific value. If your program looks for a byte of zero at the end of a message, you must put that byte there.

ample, when the Z80 uses OR to combine two values, first it ORs their highest bits, then their next highest bits, and so on. Logical operations have no concern with the total values of the operands; bit patterns are the only concern.

AND—When the Z80 ANDs, the result bit is a 1 only if both of the operand bits are 1's.

```

10010011
AND 10100110
10000010

```

Use AND to mask out unwanted bits. For example, if you want to isolate just the 4 lowest bits of an 8-bit byte, you can AND that byte with 00001111. The result copies the 4 lowest bits of the original byte into the result and sets the 4 highest bits to zero.

OR—The result bit of 2 ORed bits is a 1 if either or both of the operand bits are 1's.

```

10010011
OR 10100110
10110111

```

OR merges two values together and forms bit records in which each bit in a byte has an individual meaning.

XOR (Exclusive OR)—The result bit of 2 XORed bits is a 1 if either, but not both, of the operand bits is a 1.

```

10010011
XOR 10100110
00110101

```

Programs use XOR less often than OR and AND. Its major use is in clearing the A register and flags with the command XOR A.

An interesting fact about the XOR operation is that it is cyclic. For example, if you XOR A and B, and then XOR the result by B again, the second result is the original A value. ■

Be sure to try a test assembly of Listing 3 before you save the source code and assemble the program. With a program of this length, you can easily make a typing mistake that you must correct before the program runs correctly.

Once you get this program running, it demonstrates the speed of machine language. When you press and release a key, you see a very brief blink on the screen. In that time, it prints a space in every screen location and prints the message again until the screen is full. Even though it must print 2,028 characters, it all happens in a flicker of the screen.

Learning More

No one can learn any computer language from one article. So far you can use only a few mnemonics and a few of the many types of program logic. You are on your way, but still have much to learn.

You can do many things to develop your Assembly-language programming skills. First, read Assembly-language programs in magazines carefully and try to follow the logic of each. Most magazine programs have a lot of remarks to help you understand what they do.

Second, read through the list of Z80 mnemonics (there is an excellent list with complete explanations in the Series 1 manual) and try to imagine how you can use each variation of each instruction. Also, you might read one of the books available on beginning Assembly-language programming. William Barden's *TRS-80 Assembly-Language Programming*, available from Radio Shack, is one of the easiest to read.

Third, if you have some short machine-language programs available in your library, try to disassemble one and understand what it does without the benefit of remarks. Don't try to disassemble something as long as Scripsit or VisiCalc; such complexity will completely overwhelm you.

Most important, write your own Assembly-language programs. The more you write, the easier it becomes. Keep trying, keep writing, keep experimenting and you will soon find that Assembly language is as easy as any other computer language. ■

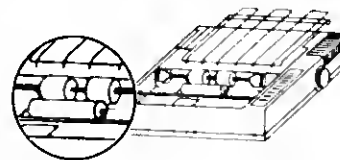
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Assembly-Language Disk I/O

by David G. Haan

With a knowledge of Assembly-language disk input/output, you can make your programs run more efficiently and solve most I/O problems.

Assembly-language disk input/output (I/O) is a complicated and advanced technique, but understanding it allows you more creativity in programming and more knowledge in troubleshooting and repairing disk I/O problems.

This article deals with the use of the Model III TRSDOS disk I/O and explains the subroutines used in reading and writing disk files. Included is a demonstration program, TESTFILE/TST, that chains these ROM routines and shows how they manipulate disk files.

Within the text, I explain how to use

each of the routines and what you can expect on entry and exit. I also point out some errors in Radio Shack's explanation of these routines. You should have a copy of the *Disk System Owner's Manual* for reference.

In order to see the results of each routine, I provide a non-destructive exit routine so you can examine the areas in memory that are affected. I list the routines alphabetically in the first section of EQU's.

I don't intend here to teach coding practice, but merely to demonstrate steps necessary to use each of the rou-

tines. At the end of this article, you should have sufficient knowledge to write Assembly-language disk I/O routines.

I will use the Program Listing (TESTFILE/TST) as a demonstration program throughout this article. If a file by the name of TESTFILE/TST exists on the disk you want to use, you should rename it.

Table 1 lists the major storage areas and buffers TESTFILE uses for system routines and their functions.

The program sets up registers before each call to a system routine. This is not always necessary since some of the registers used remain unchanged when returning from a previous routine. It is done, however, to indicate the information required prior to calling a system routine.

Following along with the Listing helps you see what registers the routines need, and what they need to contain prior to executing the routines. Table 2 shows the condition of the registers prior to and after each routine's execution.

Program Operation

The demonstration program starts by saving the HL register (see the Listing). The HL register contains the address of the first non-blank character following the last command you entered under

Storage Areas	Bytes Used	Description
BUFFER	256	Operating system uses this as a data storage area during a disk read or write. It must be 256 bytes long since all reads and writes are done one sector at a time.
UREC	less than 256	A user buffer that locates all the data you want to write to or read from disk. The system moves data between UREC and Buffer if the logical record length is less than 256 bytes.
DCB	64	Data control block contains information used by the system to read or write data from or to the disk. For a layout of the DCB, see Table 3 or the <i>Disk System Owner's Manual</i> .
KBLNBF	16	Buffer used to hold data entered via keyboard. Used in conjunction with system routine KBLINE.
DIRBUF	24	This is where RAMDIR places a single directory entry. The format of this buffer is shown in Table 4 or under RAMDIR in the <i>Disk System Owner's Manual</i> .

Table 1. Storage areas and buffers.

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TRSDOS READY. Keep this fact in mind for later reference.

Then the program checks to see if this is your initial entry into this program. It does so by looking at a storage location called Entry that contains the address of the location at which you reenter the program (if you have reentered it).

If the reentry address is between 8000 hexadecimal (hex) and 8FFF hex, Entry uses it as the reentry address. The program places the contents of Entry there with a routine called Look. Look is the non-destructive exit routine the program calls each time you execute a system program and provides a place in memory where you can look to see the effects of the routine's execution.

When you run this program for the first time, it clears the storage areas from Buffer to LKBUF. This makes it easier to see what data the system routines put into memory. Also, the program puts dummy data into the area called UREC. The program then writes this data to disk. Following this, a message indicates the start of the program.

The program then prompts you for the name of a file to which you want to write data. This is where you type in the filespec you want used in the disk's data control block (DCB). The code that asks for the filespec starts at the label GETSPC. With the B register set to 15, and the HL register set to the keyboard input buffer (KBLNBF), the system routine KBLINE lets you enter up to 15 characters for a file name.

Once you do so and hit the enter key, the system's Syntax routine checks to see if your filespec has the correct syntax. If it does, the subroutine duplicates the filespec in the DCB. Syntax uses the HL register, which points to the filespec in the keyboard input buffer (KBLNBF), and the DE register, which points to the DCB.

On return, Syntax sets or clears the zero flag, depending on whether or not the filespec syntax was good. If it is, the subroutine sets the zero flag. If not, it resets the zero flag and the program prompts you for the filespec again.

To check this system, enter any file name preceded by a blank such as BADSPEC. Press the enter key. Since this enters a bad filespec (the first character is a blank), the program displays a message asking for a filespec again.

You might think that since the file name must begin with an alpha character and have eight or fewer characters, Syntax would check this. It doesn't. It does check to see that the filespec starts with a blank, but Syntax allows the file name to start with a number and simply

truncates it to eight characters.

Also, if you use an extension and password, Syntax truncates the extension to three characters, the password to eight characters, and doesn't return an error. If you need to check for the accuracy of your filespec, better do your own checking rather than rely on the Syntax routine.

Now enter TESTFILE as a file name and press the enter key. Since this file name has the correct syntax, the subroutine copies it to the DCB and the local routine Look displays a message asking you if you want to look at the results. If you answer with anything other than Y, the program continues execution, so answer with a Y. This brings you into Debug.

You can go directly to Debug from the demonstration program by using the system routine called COMDOS. COMDOS executes any command you can execute while in TRSDOS READY from a user program. The HL register must point to the address which has the command you wish to execute. The program then executes a jump to COMDOS.

The Look routine points the HL register to the label EXECUT in the message area of the listing, which contains the program name Debug followed by a carriage return. Once in Debug, you can use the command D to look at both KBLNBF and the DCB.

To view KBLNBF, enter its address

found in the section of equates at the beginning of the program under Storage Locations. In KBLNBF, note the file name TESTFILE followed by 0DH, a carriage return. Now look at the DCB. You can find this address listed in the section of equates also.

Notice that the file names in KBLNBF, which is now below the DCB, and the DCB are the same except for one thing. The file name TESTFILE in KBLNBF is followed by 0DH while the file name in the DCB is followed by 03H. The TRSDOS *Disk System Owner's Manual* says the file name in the DCB is followed by 0DH. As you can see, this isn't true if you use the Syntax routine.

To return to the demonstration program, press the Q key to exit Debug and type in the name under which you assembled the demonstration program. This returns you to where you left off. The program displays a message on the screen indicating the location at which you reentered the program. In fact, each time you reenter the program, a message indicates the reentry point.

You should reenter the demonstration program at the label Extend. You can now enter a three-character extension that the program adds to your file name in the DCB via the PUTTEXT routine. Of course, you could have added the extension to the file name when you originally entered the filespec, but the

Routine	Registers					
	AF	BC	DE	HL	IX	IY
BKSPC	Yes	No	No	No	No	No
CLOSE	Yes	No	No	No	No	No
CMDDOS	N/A	N/A	N/A	N/A	N/A	N/A
CMDDTX	N/A	N/A	N/A	N/A	N/A	N/A
COMDOS	N/A	N/A	N/A	N/A	N/A	N/A
DIVIDE	Yes	No	No	Yes	No	No
DSPDIR	Yes	Yes	No	Yes	No	No
ERRDSP	Yes*	No	No	No	No	No
FILPTR	Yes	Yes	No	No	No	No
INIT	Yes	No	No	No	No	No
JP2DOS	N/A	N/A	N/A	N/A	N/A	N/A
KILL	No	No	No	No	No	No
OPEN	Yes	No	No	No	No	No
POSEOF	Yes	No	No	No	No	No
POSN	Yes	No	No	No	No	No
PUTEXT	Yes	Yes	No	Yes	No	No
RAMDIR	No	No	No	No	Yes	No
READ	Yes	No	No	No	No	No
REWIND	Yes	No	No	No	No	No
SYNTAX	Yes	Yes	No	Yes	No	No
VERF	Yes	No	No	No	No	No
WRITE	Yes	No	No	No	No	No

Yes = registers have changed. No = registers have not changed. N/A = not applicable.
Only the primary registers change; the demonstration program doesn't use the alternate set.
* Only the flag register changes.

Table 2. Register conditions after routine execution.

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extension is being requested here to demonstrate the routine. Enter TST as the extension.

To work properly, PUTTEXT requires that the HL register point to the location of the extension and the DE register point to the DCB. The demo program then calls PUTTEXT. There are no exit conditions to check for, so the program calls Look so you can again check the results in KBLNBF and the DCB. In the DCB, the filename now appears as TESTFILE/TST followed by 03H. Now return to the demonstration program.

You should have reentered at the label OPNFIL. Here the program attempts to open the file using the filename TESTFILE/TST. If the file had already existed, it would simply have been opened, but since the file doesn't exist, the program displays the message File Not Found. You can look at the DCB and see that nothing happened.

Before going on, look at the local routine ERPROC which contains the system routine called ERRDSP. You can find this in the Listing under the banner Error Display Processor. ERRDSP is a system routine that displays an error code or expanded error message on the CRT. It then either returns to the user program, or to TRSDOS READY. Setting bit 6 masks the error code that is in the A register. The

routine spells out the full error message.

If bit 7 is set, control returns to the user program. How you process an error is up to you. You can abort the program, try again, skip processing, or whatever you feel is appropriate. Now return to the demonstration program.

You should reenter the program at label NEWFIL. This initializes a new file and you can again look at the DCB. The parameters that the HL, BC, and DE registers pass are the same whether you open or initialize a file.

In this case, the HL register contains the address of a 256-byte buffer called Buffer where the operating system does the actual writing to and reading from the disk. The DE register must point to the DCB, and the B register must contain the logical record length.

A physical record is 256 bytes long or one disk sector. You can subdivide the physical record into smaller segments called logical records. A logical record is a record of from 1 to 256 bytes long. In the EQUs, I define the logical record length (LRL) as 128 bytes long.

If you define a logical record as 64 bytes long, four logical records comprise one physical record ($4 \times 64 = 256$). However, if a logical record does not evenly divide into a 256-byte physical record (such as a logical record of 50 bytes), the system spans physical records to keep your logical records intact.

It's possible to have a logical record equal in size to the physical record (256 bytes), but this requires additional programming. I'll discuss how the data moves to and from disk and the special requirements for 256-byte logical records later.

For now, answer Y to the question on the screen and take a look at the DCB. Notice that the program file name in the DCB no longer appears. Instead, the DCB's layout is as shown in Table 3. Bytes 3 and 4 of the DCB point to the 256-byte buffer called Buffer. Remember, the low order byte appears first, the high order byte second.

Byte 5 represents the offset to the delimiter at the end of the current physical record. Byte 6 indicates the drive number on which the file resides. Byte 8 is the end-of-file offset of the last delimiter in the last physical record. Byte 9 shows the logical record length, and bytes 10 and 11 display the next physical record number with bytes 12 and 13 giving the ending physical record of the file.

Figures 1 and 2 show examples of how to interpret the contents of bytes 5, 8, 10, and 11 of the DCB. Figure 1 shows two physical records, or sectors, of 256 bytes each, comprising four 128-byte logical records.

Suppose you just read the first logical record (record zero) of physical record zero. Byte 5 of the DCB now contains 80 hex and bytes 10 and 11 of the DCB contain 0000 hex. The DCB now points to the first byte of the next logical record.

Logical record zero goes from bytes 0 hex to 7F hex, and logical record 1 goes from bytes 80 hex to 0FF hex. Byte 5 of the DCB actually contains the first byte following the end of the last logical record read or, for that matter, the last one written.

Figure 2 is similar to Fig. 1 (now in the second logical record of physical record zero). Here, byte 5 of the DCB contains 0 hex, and bytes 10 and 11 of the DCB contain 0001 hex. The DCB now points to the first byte of logical record 2, the first logical record of physical record 1.

Byte 8 of the DCB is similar to byte 5 of the DCB, but only applies to the last physical record in the file. It points to the first byte following the last logical record in the last physical record.

In Fig. 2, if the last logical record in the file is logical record 2, byte 8 of the DCB contains 80 hex. This is actually the first byte of the next logical record, if it existed. You should note that the value in byte 8 need not always point to

Byte	Contents
0-2	Reserved for system use.
3-4	Address of system I/O buffer. (BUFFER)
5	Offset into the current physical record of the end of the last logical record read or written.
6	Drive number on which the file exists.
7	Reserved for system use.
8	End Of File offset to the end of the last logical record.
9	Logical record length.
10-11	The next physical record where a read or write will take place.
12-13	The last physical record in the file.
14-63	Reserved for system use.

Table 3. Data control block layout.

Byte	Contents
0-14	File name/ext:d left justified and padded with spaces.
15	Protection level of file. 0 to 6.
16	End Of File offset to the end of the last logical record in the last physical record.
17	The logical record length.
18-19	The last physical record number in the file. LSB is in byte 18 and the MSB is in byte 19.
20-21	The number of granules allocated to the file. LSB is in byte 20 and the MSB is in byte 21.
22-23	Two plus marks indicating the end of the directory.

Table 4. Directory layout in RAM.

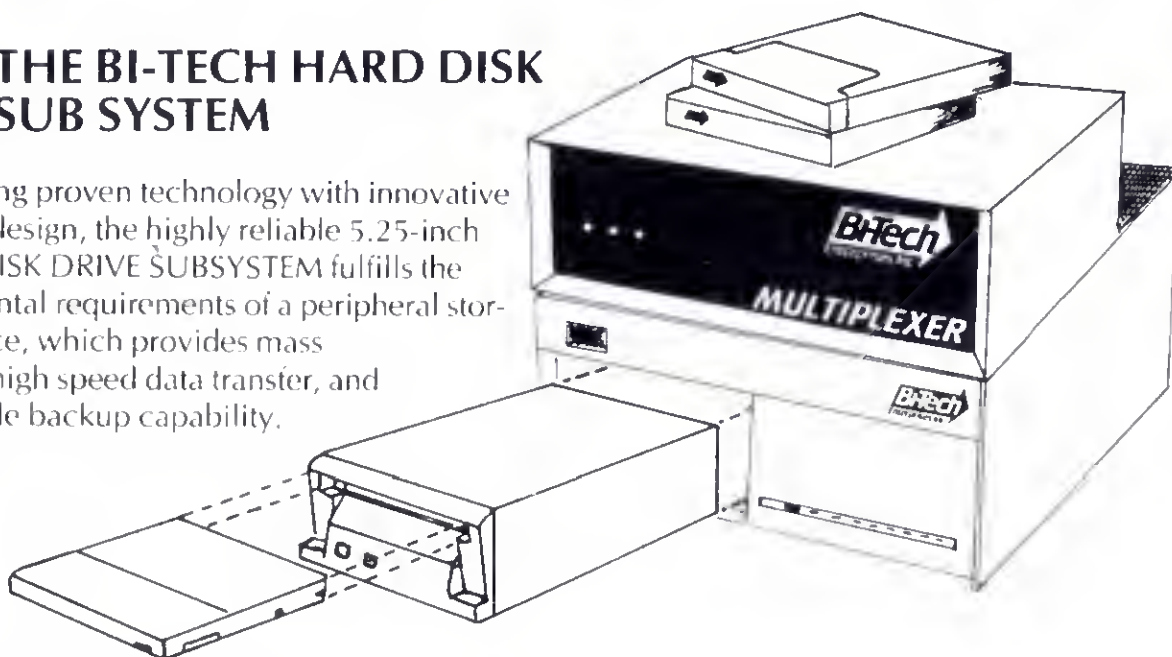


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the beginning of the next logical record. It can point anywhere within your last logical record. It is meant to point to the first byte following the actual end of data.

To make sure you put the correct end-of-file (EOF) offset in the DCB, you must calculate and put the actual EOF offset into byte 8 of the DCB. One way you can experiment with this is to use this program with different logical record lengths and modify the end-of-file offset in byte 8 of the DCB just before closing the file. To keep it simple, don't do it here. Now return to the demonstration program.

Write Operation

Once you return from looking at the DCB, execute the code at the WRTFIL label. The system needs two pieces of data to write a record to disk. The HL register must point to the buffer that contains the data you want to save, and the DE register must point to the DCB. The program sets the HL register to point to UREC, which contains some sample data, while the DE register points to the DCB.

When the program invokes the Write subroutine, it moves 128 bytes (the logical record length) from UREC to the area called Buffer. If the write is successful, it sets the zero flag. If an error occurs, the subroutine resets the zero flag and returns an error code in the A register for display via ERPROC.

As long as the logical record length is fewer than 256 bytes long, the system

moves data from the user buffer UREC to the I/O buffer called Buffer and vice versa.

If you set the logical record length to 256 by opening a file with the B register equal to zero, you must move the data between UREC and Buffer yourself. This means that for each Write command, you must move the 256 bytes of data you want written to Buffer before the program calls the Write routine. Also, after each read, you must move the 256 bytes from Buffer to wherever you want it to go as its final destination. When the logical record length is 256 bytes, Read and Write commands ignore the HL register.

Once you complete the first write of the logical record of 128 bytes, answer Y to the question on the screen and look at Buffer and the DCB. If you look at the DCB, you see that the next physical record number at bytes 10 and 11 is zero. Also, the offset to the delimiter at the end of the current physical record at byte 5 is 80 hex, indicating that the program successfully completed one write. Records start at number zero with two 80 hex logical records per physical record. Looking at Buffer, you can see the dummy data.

Return to the demonstration program to continue with the next write at label WRT002. The program now initiates a second disk write, but here the HL register points one logical record length (1 LRL) into UREC. This occurs so the system can pick up the next block of data.

Make sure the HL register points to the right area of memory for the data you want transferred. If the write is successful, the program transfers a sector of data, or 2 LRLs, from Buffer to the disk. Again, you can look at the DCB and buffer areas for verification.

Now the DCB shows that the next physical record number at bytes 10 and 11 is 1 and the ending physical record at bytes 12 and 13 is also 1. The offset to the end of the current record at byte 5 is zero, indicating that the program has written two logical records.

After returning to the demonstration program at label WRT003, the program completes a third write, after which you may look at the DCB. Notice that the last half of the buffer contains junk. The program clears out Buffer after it writes a sector and loads it with data of its own choosing from somewhere in the system.

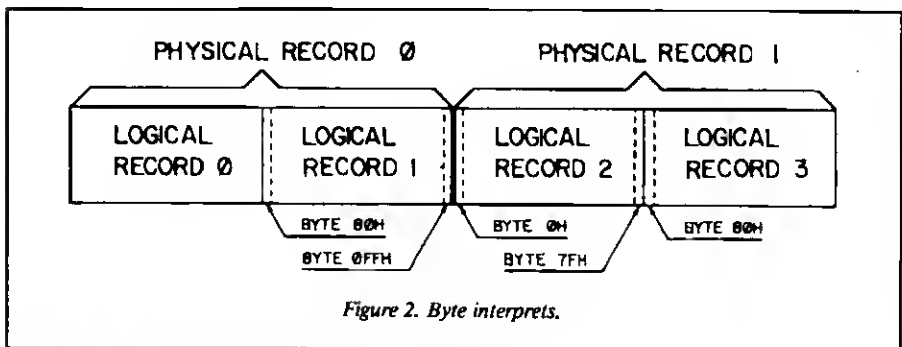
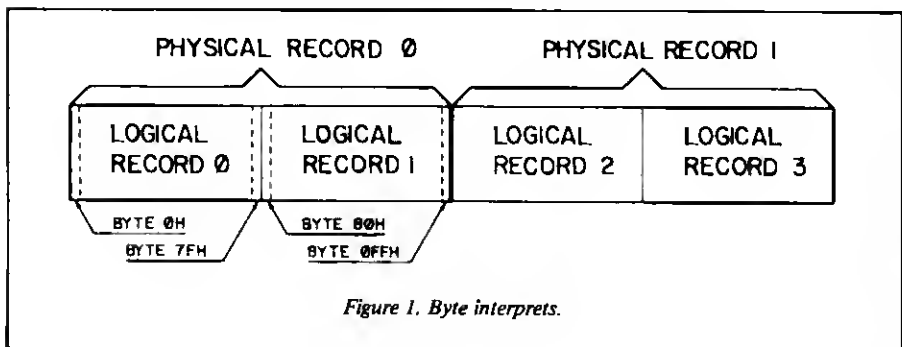
Now, return to the demonstration program at label WRT004 for a fourth disk write. Following this, at label WRT005, the program makes a fifth write. After each of these writes you may look at the DCB.

Since the fifth write is only half of a new third sector, the DCB shows that the next physical record is 2 (the third physical record), the ending physical record is 2, and the offset is 80 hex at byte 5, for a total of five 80 hex-byte logical records.

In the *Disk System Owner's Manual* the explanation of the next record number (NRN) as well as those of Read and Write operations, say that after each Read or Write the NRN increments by one. This is true only if the logical record length is 256 bytes long. If the logical record length is 128 bytes as in this case, the NRN increments only after two reads or writes.

You should now return to the program to close the file. You enter at label CLOSFL. To close a file, you need to pass only one parameter to the routine called Close. This is the address of the DCB in the DE register. When you close the file, the program makes a final write to the disk, keeps track of the end of the last logical record, and updates the DCB and the disk directory.

If you close the file successfully, the program sets the zero flag. If not, you need to process the error. Get into Debug and look at the DCB. As you can see, the file name, including the number of the disk drive where the file is located, again appears at the beginning of the DCB. If you call the directory, notice that the file has an LRL of 128 bytes, five logical records, three physi-



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cal records (one granule), and an EOF of 128 bytes.

If you want to quit and take a break, go ahead, but if you turn off your computer or run some other program, make sure you reenter the program at the correct point. To do this, use the M command under Debug and modify the location Entry so that it points to GTSPC1 in the demonstration program.

Remember, the low order byte of the address of GTSPC1 goes into the low order byte of Entry, and the high order byte of the address of GTSPC1 goes into the high order byte of Entry. Now you can exit Debug and continue with the rest of this article.

Read Operation

Now I'll show you how to read the disk file you generated. You will read

four records, the first, then the third, then back to the first, and finally the fifth logical record.

By typing in the name of the demonstration program, reenter the program. Do this, but with one additional entry, the name of the data file (TEST-FILE/TST) following the name of the demonstration program.

For example, if the name of the demonstration program is DISKIO, type DISKIO TESTFILE/TST. You must include a single space between the program name DISKIO and the data file name. Every time you type in a command at TRSDOS READY, the HL register contains the address of the first non-blank character following the last command. The *Disk System Owner's Manual* describes this in detail under CMDTXT.

Once you type in the demonstration program name followed by the data file name, the program automatically saves the HL register in the location labeled PARAM. This brings you to the read section of the program at label

*"If you close
the file successfully,
the program
sets the zero flag."*

GTSPC1, with an accompanying message. Then the program loads the HL register with the address contained in the location PARAM. The Read routine checks this address to see if it includes a carriage return, indicating the end of a command, and the absence of parameters to pass. If no parameters exist, the program asks you to enter the filespec just as when you initially ran the program.

If you typed in the parameter TEST-FILE/TST, the program uses this as the filespec to open the file. If you type an illegal parameter, an error occurs and you must enter a new filespec.

If everything goes right, the program opens the TESTFILE/TST file, ready to read. Before the program reads the file, it executes the FILPTR routine starting at label OPENOK. This routine requires that the DE register contain the DCB address. On return from FILPTR the B register contains the drive number on which the file resides, with the logical file number in the C register.

Program Listing. Demonstration program.

```

00010 ;
00020 ;*****
00030 ; FUNDAMENTAL ASSEMBLY LANGUAGE DISK I/O
00040 ; FOR THE TRS-80 MODEL III
00050 ;*****
00060 ;
00070 ORG 0000H
00080 BKSPC EQU 4445H ;BACKSPACE 1 LOGICAL REC
00090 CLOSE EQU 4428H ;CLOSE FILE ROUTINE
00100 CMDDOS EQU 429CH ;EXEC TRSDOS COMMAND
00110 CMDTXT EQU 4225H ;HAS LAST TRSDOS COMMAND
00120 COMDOS EQU 4299H ;EXEC TRSDOS COMMAND
00130 DIVIDE EQU 4451H ;DIVIDE ROUTINE
00140 DSPDIR EQU 4419H ;DISPLAY DIRECTORY
00150 ERRDSP EQU 4409H ;DISPLAY ERROR MESSAGE
00160 FILPTR EQU 428DH ;FINDS FILE # AND DRIVE #
00170 IMIT EQU 4420H ;INITIALIZE DISK FILE
00180 JP2DOS EQU 402DH ;ENTRY TO TRSDOS
00190 KILL EQU 442CH ;KILLS FILE
00200 OPEN EQU 4424H ;OPEN FILE ROUTINE
00210 POSEOF EQU 4440H ;GO TO END OF FILE
00220 POSN EQU 4442H ;POSITION TO LOGICAL REC.
00230 PUTEXT EQU 444BH ;PUT EXTENSION IN DCB
00240 RAMDIR EQU 4290H ;RAM DIRECTORY ROUTINE
00250 READ EQU 4436H ;DISK READ ROUTINE
00260 RENIND EQU 443PH ;REWIND FILE ROUTINE
00270 SYNTAX EQU 441CH ;CHECK FILESPEC SYNTAX
00280 VERF EQU 443CH ;WRITE AND VERIFY
00290 WRITE EQU 4439H ;DISK WRITE ROUTINE
00300 ;
00310 ;*****
00320 ; MISCELLANEOUS ROUTINES AND DEFINITIONS
00330 ;*****
00340 ;
00350 KBLINE EQU 40H ;SCAN KEYBOARD FOR LINE
00360 KBWAIT EQU 49H ;WAIT FOR KEYBOARD INPUT
00370 LRL EQU 120 ;LOGICAL RECORD LENGTH
00380 LAL2 EQU 256 ;LOGICAL RECORD X2
00390 VDCLS EQU 1C9H ;CLEAR SCREEN ROUTINE
00400 VDLIN EQU 21BH ;DISPLAY LINE ROUTINE
00410 ;
00420 ;*****
00430 ; STORAGE LOCATIONS
00440 ;*****
00450 ;
00460 ADRBUF EQU $ ;ADDRESS OF 'BUFFER'
00470 BUFFER DEFS 256 ;DISK I/O BUFFER
00480 AUREC EQU $ ;ADDRESS OF 'UREC'
00490 UREC DEFS 640 ;USER BUFFER
00500 ADRDCB EQU $ ;ADDRESS OF 'DCB'
00510 DCB DEFS 64 ;DATA CONTROL BLOCK
00520 AKBBUF EQU $ ;ADDRESS OF 'KBLNBP'
00530 KBLNBP DEFS 16 ;KEYBOARD INPUT BUFFER
00540 ADRDIR EQU $ ;ADDRESS OF 'DIRBUF'
00550 DIRBUF DEFS 24 ;DIRECTORY BUFFER
00560 LENGTH EQU $-BUFFER
00570 DRVNUM DEFS 1 ;ASCII CODED DRIVE NUMBER
00580 LKBUF DEFS 2
00590 AENTRY EQU $ ;ADDRESS OF RE-ENTRY BUF
00600 ENTRY DEFS 2 ;RE-ENTRY ADDRESS BUFFER
00610 PARAM DEFS 2 ;PARAMETER ADDRESS BUFFER
00620 ;
00630 ;*****
00640 ; WRITE DISK FILE EXERCISE
00650 ;*****
00660 ;
00670 START LD (PARAM),HL ;SAVE PARAMETER POINTER
00680 CALL VDCLS ;CLEAR SCREEN
00690 LD HL,(ENTRY) ;GET RE-ENTRY ADDRESS
00700 LD A,H
00710 AND 0F0H
00720 CP 00H ;IS THIS FIRST TIME THRU?
00730 JR NZ,STARTI ;YES
00740 JP (HL) ;NO. ENTER WHERE LEFT OFF
00750 STARTI CALL CLRBUF ;CLEAR OUT BUFFERS
00760 CALL MOVDAT ;FILL USER BUFFER W/DATA
00770 LD HL,SIGNON ;SIGNON MESSAGE
00780 CALL VDLIN ;DISPLAY MESSAGE
00790 GETSPC LD HL,SPCMMSG ;FILESPEC MESSAGE
00800 CALL VDLIN ;DISPLAY MESSAGE
00810 LD HL,KBLNBP ;KEYBOARD INPUT BUFFER
00820 LD B,15 ;MAX # OF CHARS. ALLOWED
00830 CALL KBLINE ;GET FILESPEC
00840 LD HL,KBLNBP ;FILESPEC ADDRESS

```

Listing continued

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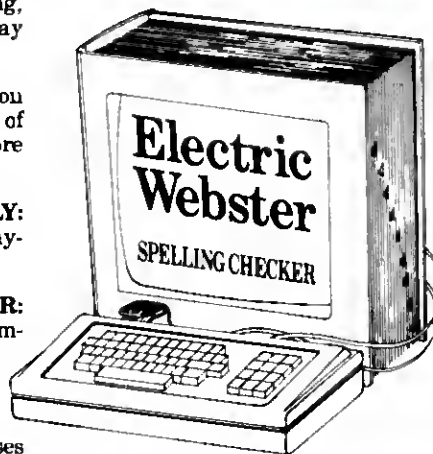
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If FILPTR finds the appropriate information, it sets the zero flag. Otherwise, it resets the flag and the program skips down to the label READ01.

On successful completion of FILPTR, the routine RAMDIR uses the BC register, returned by FILPTR, to get the directory information of TESTFILE/TST and places it in memory.

RAMDIR requires that the BC register contain the drive number in the B register, the file number in the C register, and the address of a 24-byte buffer in the HL register. The 24-byte buffer in this case is DIRBUF. The *Disk System Owner's Manual* states that the buffer must be 22 bytes long for data, plus 1 byte for the plus symbol, which indicates the end of the directory. In fact, there are two plus marks at the end of the directory, thereby requiring 24 bytes in the buffer. If RAMDIR is successful, it sets the zero flag.

Following the execution of RAMDIR, the program converts the drive number and file number of TESTFILE/TST contained in the BC register to ASCII and places them in two separate messages. In addition, it saves the ASCII coded drive number in a location labeled DRVNUM for later use

```

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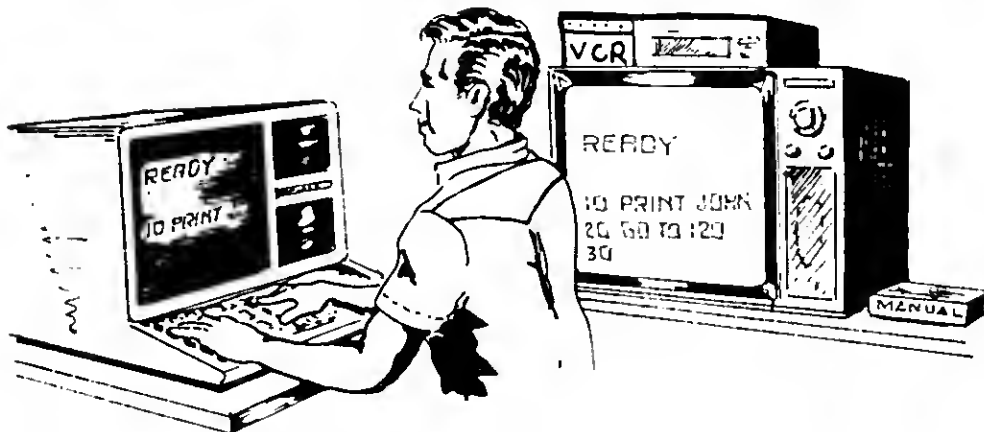
Listing continued

```

00850 LD DE,DCB ;DATA CONTROL BLOCK
00860 CALL SYNTAX ;TEST FOR CORRECT SYNTAX
00870 JR NZ,GETSPC ;BAD SYNTAX
00880 CALL LOOK ;EXAMINE FILESPEC ?
00890 CALL MSG001 ;DISPLAY ENTRY MESSAGES
00900 LD HL,KBLNBF ;KEYBOARD INPUT BUFFER
00910 LD B,3 ;ALLOWS 3 CHAR. ENTRY
00920 CALL KBLINE ;GET EXTENSION
00930 LD HL,KBLNBF ;EXTENSION ADDRESS
00940 LD DE,DCB ;DATA CONTROL BLOCK
00950 CALL PUTTEXT ;ADD EXTENSION TO FIESPC
00960 CALL LOOK ;EXAMINE FILESPEC ?
00970 CALL MSG002 ;DISPLAY ENTRY MESSAGES
00980 LD HL,BUFFER ;ADDR SECTOR I/O BUFFER
00990 LD DE,DCB ;DATA CONTROL BLOCK
01000 LD B,LRL ;LOGICAL RECORD LENGTH
01010 CALL OPEN ;OPEN FILE
01020 JR Z,INITOK ;FILE OPENING SUCCESSFUL
01030 CALL ERPRDC ;DISPLAY ERROR MESSAGE
01040 CALL LOOK ;EXAMINE DCB ?
01050 CALL MSG003 ;DISPLAY ENTRY MESSAGES
01060 LD HL,BUFFER ;ADDR SECTOR I/O BUFFER
01070 LD DE,DCB ;DATA CONTROL BLOCK
01080 LD B,LRL ;LOGICAL RECORD LENGTH
01090 CALL INIT ;INITIALIZE A NEW FILE
01100 JR Z,INITOK ;NEW FILE INITIALIZED
01110 CALL ERPRDC ;DISPLAY ERROR MESSAGE
01120 CALL LOOK ;EXAMINE DCB ?
01130 CALL MSG004 ;DISPLAY ENTRY MESSAGES
01140 LD HL,UREC ;USER BLOCK
01150 LD DE,DCB ;DATA CONTROL BLOCK
01160 CALL VREF ;WRITE DATA TO DISK
01170 JR Z,WRTOK1 ;SUCCESSFUL WRITE
01180 CALL ERPRDC ;DISPLAY ERROR MESSAGE
01190 CALL LOOK ;EXAMINE BUFFERS ?
01200 CALL MSG005 ;DISPLAY ENTRY MESSAGES
01210 LD HL,UREC+LRL ;NEXT LRL OF DATA
01220 LD DE,DCB ;DATA CONTROL BLOCK
01230 CALL WRITE ;WRITE DATA TO DISK
01240 JR Z,WRTOK2 ;SUCCESSFUL WRITE
01250 CALL ERPRDC ;DISPLAY ERROR
01260 CALL LOOK ;EXAMINE BUFFERS ?
01270 CALL MSG006 ;DISPLAY ENTRY MESSAGES
01280 LD HL,UREC+LRL2 ;NEXT LRL OF DATA
01290 LD DE,DCB ;DATA CONTROL BLOCK
01300 CALL WRITE ;WRITE DATA TO DISK
01310 JR Z,WRTOK3 ;SUCCESSFUL WRITE
01320 CALL ERPRDC ;DISPLAY ERROR
01330 CALL LOOK ;EXAMINE BUFFERS ?
01340 CALL MSG007 ;DISPLAY ENTRY MESSAGES
01350 LD HL,UREC+LRL+LRL2 ;DATA CONTROL BLOCK
01360 LD DE,DCB ;WRITE DATA TO DISK
01370 CALL WRITE ;SUCCESSFUL WRITE
01380 JR Z,WRTOK4 ;DISPLAY ERROR
01390 CALL ERPRDC ;EXAMINE BUFFERS ?
01400 CALL LOOK ;DISPLAY ENTRY MESSAGES
01410 CALL MSG008 ;DATA CONTROL BLOCK
01420 LD HL,UREC+LRL2+LRL2 ;WRITE DATA TO DISK
01430 LD DE,DCB ;SUCCESSFUL WRITE
01440 CALL WRITE ;DISPLAY ERROR
01450 JR Z,WRTOK5 ;EXAMINE BUFFERS ?
01460 CALL ERPRDC ;DISPLAY ENTRY MESSAGES
01470 CALL LOOK ;DATA CONTROL BLOCK
01480 CALL MSG009 ;CLOSE FILE
01490 LD DE,DCB ;FILE CLOSED SUCCESSFULLY
01500 CALL CLOSE ;DISPLAY ERROR MESSAGE
01510 JR Z,CLOSOK ;GET RE-ENTRY ADDRESS
01520 CALL ERPRDC ;SET NEW RE-ENTRY ADDRESS
01530 LD HL,GTSPC1 ;JUMP TO TRSDOS READY
01540 LD (ENTRY),HL
01550 JP J2DOS
01560 ;
01570 ;
01580 ; READ DISK FILE EXERCISE
01590 ;
01600 ;
01610 GTSPC1 CALL CLRBUF ;CLEAR OUT BUFFERS
01620 CALL MSG010 ;DISPLAY ENTRY MESSAGES
01630 LD HL,(PARAM) ;GET PARAMETER ADDRESS
01640 LD A,(HL) ;FIRST CHARACTER OF PARAM
01650 CP 0DH ;CARRIAGE RETURN ?
01660 JR NZ,RDOPEN ;OPEN FILE USING PARAM.
01670 LD HL,SPCMMSG ;GET FILESPEC MESSAGE
01680 CALL VDLINE ;DISPLAY MESSAGE
01690 LD HL,KBLNBF ;KEYBOARD INPUT BUFFER
01700 LD B,15 ;MAX # CHARS FROM KEYBD
01710 CALL KBLINE ;INPUT KEYBOARD DATA
01720 LD HL,KBLNBF ;FILESPEC
01730 LD DE,DCB ;DATA CONTROL BLOCK
01740 CALL SYNTAX ;CHECK FOR CORRECT SYNTAX
01750 JR NZ,GTSPC2 ;BAD SYNTAX
01760 LD HL,BUFFER ;SECTOR I/O BUFFER
01770 LD DE,DCB ;DATA CONTROL BLOCK
01780 LD B,LRL ;LOGICAL RECORD LENGTH
01790 CALL OPEN ;OPEN FILE
01800 JR Z,OPENOK ;OPENED SUCCESSFULLY
01810 CALL ERPRDC ;DISPLAY ERROR MESSAGE
01820 CALL GTSPC2 ;GET NEW FILESPEC
01830 LD DE,DCB ;DATA CONTROL BLOCK
01840 CALL FILPTR ;GET DRV/FILE # IN BC REG
01850 JR NZ,READ01 ;SKIP IF ERROR
01860 LD HL,DIRBUF ;DIRECTORY BUFFER
01870 CALL RAMDIR ;GET DIRECTORY INFO
01880 JR NZ,READ01 ;SKIP IF ERROR
01890 LD A,B ;PUT DRIVE # IN A REG
01900 ADD A,30H ;MAKE ASCII
01910 LD (DRVNUM),A ;SAVE FOR ROUTINE DSPDIR
  
```

Listing continued

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```

01920      LO      (DRVBUF),A      ;PUT IN MESSAGE
01930      LD      L,C              ;SET UP BL REGISTER TO
01940      LD      H,H              ; MAKE FILE NUMBER AM
01950      LD      A,1H             ; ASCII STRING.
01960      CALL    DIVIDE
01970      ADD     A,3BH             ;MAKE REMAINDER ASCII
01980      LD      (FILNUM+1),A      ;SAVE IR MESSAGE
01990      LO      A,L              ;GET REST OF FILE NUMBER
02000      ADD     A,3BH             ;MAKE IT ASCII
02010      LO      (FILNUM),A       ;PUT IN MESSAGE
02020      LO      SL,DRVMSG        ;DRIVE NUMBER MESSAGE
02030      CALL    VDLIN           ;DISPCLAY MESSAGE
02040      LD      HL,FILMSG        ;FILE NUMBER MESSAGE
02050      CALL    VDLIN           ;DISPLAY REST OF MESSAGE
02060      CALL    LOOK             ;EXAMINE DIRECTORY ?
02070      READ#1 CALL MSG#11        ;DISPLAY ENTRY MESSAGES
02080      LO      HL,UREC          ;USER DATA BUFFER
02090      LD      DE,DCB           ;DATA CONTROL BLOCK
02100      CALL    READ            ;READ A LOGICAL RECORD
02110      JR      Z,READOK        ;RECORD READ OK
02120      CALL    ERPRDC          ;DISPCLAY ERROR MESSAGE
02130      CALL    LOOK            ;EXAMINE SUPPERS ?
02140      POBENT CALL MSG#12        ;DISPLAY ENTRY MESSAGES
02150      LO      DE,DCB          ;DATA CONTROL BLOCK
02160      LD      BC,2             ;LRL TO GO TO
02170      CALL    POSN            ;GO TO 3RD LOGICAL RECORD
02180      JR      Z,POSNOK        ;POSITIONED OK
02190      CALL    ERPRDC          ;DISPCLAY ERROR MESSAGE
02200      CALL    LOOK            ;EXAMINE DCS ?
02210      READ#2 CALL MSG#13        ;DISPLAY ENTRY MESSAGES
02220      LO      HL,UREC+LRL     ;OFFSET INTO BUFFER 1 LRL
02230      LD      DE,DCB          ;DATA CONTROL BLOCK
02240      CALL    READ            ;READ NEXT LOGICAL RECORD
02250      JR      Z,RDOK          ;NEXT RECORD READ OK
02260      CALL    ERPRDC          ;DISPCLAY ERROR MESSAGE
02270      RDOK  CALL LOOK          ;EXAMINE BUFFERS ?
02280      REWENT CALL MSG#14        ;DISPLAY ENTRY MESSAGES
02290      LD      DE,DCB          ;DATA CONTROL BLOCK
02300      CALL    REWIND          ;GO TO BEGINNING OF FILE
02310      JR      Z,RENOK        ;REWIND COMPLETE
02320      CALL    ERPRDC          ;PROCESS ERROR MESSAGE
02330      CALL    LOOK            ;EXAMINE BUFFERS ?
02340      READ#3 CALL MSG#15        ;DISPLAY ENTRY MESSAGES
02350      LO      HL,UREC+LRL2     ;NEXT LOGICAL RECORD
02360      LD      DE,DCB          ;DATA CONTROL BLOCK
02370      CALL    READ            ;READ FIRST LOGICAL REC
02380      JR      Z,RDOK1         ;FIRST LOG REC READ OK
02390      CALL    ERPRDC          ;PROCESS ERROR MESSAGE
02400      RDOK1 CALL LOOK          ;EXAMINE SUPPERS ?
02410      EOFENT CALL MSG#16        ;DISPLAY ENTRY MESSAGES
02420      LO      DE,DCB          ;DATA CONTROL BLOCK
02430      CALL    POSEOF          ;GO TO END OF FILE
02440      JR      Z,EOFOK        ;POSITIONED TO EOF OR
02450      CALL    ERPRDC          ;PROCESS ERROR MESSAGE
02460      EOFOK CALL LOOK          ;EXAMINE SUPPERS ?
02470      SWENT CALL MSG#17        ;DISPLAY ENTRY MESSAGES
02480      LO      DE,DCB          ;DATA CONTROL BLOCK
02490      CALL    SKSPC           ;BACK UP 1 LOGICAL RECORD
02500      JR      Z,BKSPOK        ;BACKSPACE 1 LRL OK
02510      CALL    ERPRDC          ;PROCESS ERROR MESSAGE
02520      BKSPOK CALL LOOK          ;EXAMINE SUPPERS ?
02530      READ#4 CALL MSG#18        ;DISPLAY ENTRY MESSAGES
02540      LD      HL,UREC+LRL2+LRL ;USER BUFFER
02550      LD      DE,DCB          ;DATA CONTROL BLOCK
02560      CALL    READ            ;READ LOGICAL RECORD
02570      JR      Z,RDOK2         ;READ SUCCESSFUL
02580      CALL    ERPRDC          ;PROCESS ERROR MESSAGE
02590      RDOK2 CALL LOOK          ;EXAMINE SUPPERS ?
02600      CLSENT CALL MSG#19        ;DISPLAY ENTRY MESSAGES
02610      LD      DE,DCB          ;DATA CONTROL BLOCK
02620      CALL    CLOSE           ;CLOSE FILE
02630      JR      Z,KILFIL        ;CLOSE OF FILE OK
02640      CALL    ERPRDC          ;PROCESS ERROR MESSAGE
02650      KILFIL LO BL,FILMSG        ;KILLING FILE MESSAGE
02660      CALL    VDLIN           ;DISPCLAY MESSAGE
02670      LD      DE,DCB          ;DATA CONTROL BLOCK
02680      CALL    KILL            ;KILL FILE
02690      JR      Z,KILLOK        ;KILL SUCCESSFUL
02700      CALL    ERPRDC          ;PROCESS ERROR
02710      KILLOK LO A,(DRVNUM)      ;GET DRIVE NUMBER
02720      LD      (42718),A        ;PUT IN SYSTEM AREA
02730      CALL    DSPDIR          ;DISPCLAY DIRECTORY
02740      LD      HL,ENDMSG        ;END OF DEMO MESSAGE
02750      CALL    VDLIN           ;DISPLAY MESSAGE
02760      CALL    KSWAIT          ;WAIT FOR KEYBOARD ENTRY
02770      JP      JP2D08          ;GO TO TRSDOS READY
02780
02790      ;*****
02800      ;***** ERROR DISPLAY PROCESSOR *****
02810      ;*****
02820      ;
02830      ERPROC OR      BCBH        ;DISPCLAY MODE FOR ERRDSP
02840      CALL    ERRDSP          ;DISPCLAY ERROR MESSAGE
02850      RET
02860      ;
02870      ;*****
02880      ;***** EXAMINE DATA PROCESSOR *****
02890      ;*****
02900      ;
02910      LOOK  POP      SL          ;GET RETURN ADDRESS
02920      PUSH    SL              ;RESTORE IT
02930      LD      (ENTRY),BL      ;SAVE RETURE ADDRESS
02940      LD      SL,LKMSG        ;LOOP? MESSAGE
02950      CALL    VDLIN           ;DISPLAY MESSAGE
02960      LD      HL,LASUP        ;ANSWER BUFFER
02970      LD      S,1              ;ALLOW 1 CBAR TO RTN

```

Listing continued

by the system routine DSPDIR.

The program displays the messages and calls Look so you can see the directory in RAM. You can use the directory to find out how many records are in the file, the file's logical record length, and other information needed to read the file. See Table 4 for the directory's layout.

Since you already know the number of logical records and the logical record length, returning to the demonstration program after looking at the directory leads right into reading the file starting at label READ01.

When you open a file, the data in the DCB points to the first logical record in the file. A message indicates that you are reading the first logical record. With the HL register pointing to UREC and the DE register pointing to the DCB, the program makes a call to Read. If the read is successful, it sets the zero flag and puts the first logical record into UREC. This gives you an opportunity to look at the buffer UREC.

After looking at UREC, return to the

*"You can use the directory
to find out
how many records
are in the file."*

demonstration program. You should reenter at the label POSENT where the routine POSN executes so you can read the third logical record. POSN requires that the BC register point to the logical record to which you want to read or write. Since the logical records start with record zero, record 2 is the third logical record, therefore BC equals 2.

The DE register must point to the DCB. If the positioning is successful, the subroutine sets the zero flag and a Look call lets you view the DCB. You should note here that the next physical record number at bytes 10 and 11 in the DCB is now 1, and byte 5 (the offset to delimiter at end of current physical record) is zero. This confirms your position at the end of the second logical record and points to the third logical record.

Now return to the demonstration program reentering at the label READ02. Here the program reads the third logical record. The program loads the HL register with UREC plus LRL, allowing the next read from the disk to place the data in the next 128 bytes of

the user buffer UREC. The program next loads the DE register with the DCB address and executes a Read command. On successful completion, a call to Look lets you examine UREC and the DCB.

Now return to the demonstration program at label REWENT where it executes a Rewind routine. This routine requires that the program load only the DE register with the address of the DCB. Once the program executes Rewind, the DCB points to the beginning of the file, record zero. Again, a successful execution sets the zero flag and you can look at the DCB via Look.

Returning to the demonstration program should place you at the label READ03. Here the program reads the first logical record. The HL register points one more logical record length into UREC, and the DE register contains the DCB address. The call to Read reads the first logical record into UREC. Following a successful read, you can look at UREC to verify that it now contains the first, third, and first logical records of TESTFILE/TST.

You can do one of two things in order to read the last logical record. You can use the POSN routine to go to logical record 5, or you can go to the end of the file and backspace one logical record. Here I do the latter.

Return to the demonstration program at label EOFENT. The DE register contains the address of the DCB and the program calls POSEOF. If successful, it sets the zero flag and the DCB points to the beginning of the next logical record beyond the last logical record.

For a write operation, you can extend the file here. But since you're reading and you want to look at the last logical record, you must backspace one record. If you looked at the DCB after the program executes POSEOF, return to the demonstration program at label BKENT.

With the DE register pointing to the DCB address, a call to BKSPC repositions the pointer in the DCB to the last logical record. To allow examination of the DCB, the program calls the Look routine. Considering bytes 10 and 11, the next physical record is 2 and the offset to delimiter at end of current record at byte 5 is zero. This verifies that the DCB is pointing to the fifth logical record.

Continuing with the demonstration program at label READ04, it loads the HL register with the address of the next logical record position into UREC and places the address of the DCB in the DE

Listing continued

```

02988      CALL      KHLINL      ;GET CHARACTER
02990      JR        C,LOOK1     ;BREAK KEY PRESSED
03000      LD        A,(HL)      ;GET ANSWER
03010      CP        'Y'        ;HAS IT YES ?
03020      RET        NZ        ;NO
03030      LD        HL,EXECUT    ;ADDRESS OF COMMAND
03040      JP        COMDOS      ;ENTER DEBUG
03050
03060      ;
03070      ; ***** ENTRY POINT MESSAGE DISPLAY ROUTINES *****
03080      ;
03090      ;
MSG001 LD      HL,ENTMSG      ;ENTRY POINT MESSAGE
CALL     VDLINL             ;DISPLAY MESSAGE
LD      HL,ENT001           ;ENTRY POINT NAME #1
CALL     VDLINL             ;DISPLAY IT
LD      HL,EXTMSG           ;PROMPT FOR EXTENSION
CALL     VDLINL             ;DISPLAY MESSAGE
RET
MSG002 LD      HL,ENTMSG      ;ENTRY POINT MESSAGE
CALL     VDLINL             ;DISPLAY MESSAGE
LD      HL,ENT002           ;ENTRY POINT NAME #2
CALL     VDLINL             ;DISPLAY IT
LD      HL,OPNMSG           ;OPEN FILE MESSAGE
CALL     VDLINL             ;DISPLAY MESSAGE
RET
MSG003 LD      HL,ENTMSG      ;ENTRY POINT MESSAGE
CALL     VDLINL             ;DISPLAY MESSAGE
LD      HL,ENT003           ;ENTRY POINT NAME #3
CALL     VDLINL             ;DISPLAY IT
LD      HL,INITMS           ;INITIALIZING FILE MSG
CALL     VDLINL             ;DISPLAY MESSAGE
RET
MSG004 LD      HL,ENTMSG      ;ENTRY POINT MESSAGE
CALL     VDLINL             ;DISPLAY MESSAGE
LD      HL,ENT004           ;ENTRY POINT NAME #4
CALL     VDLINL             ;DISPLAY IT
LD      HL,LRL1ST           ;'FIRST' LOGICAL REC MSG
CALL     VDLINL             ;DISPLAY IT
LD      HL,WRT001           ;WRITING LOGICAL REC MSG
CALL     VDLINL             ;DISPLAY MESSAGE
RET
MSG005 LD      HL,ENTMSG      ;ENTRY POINT MESSAGE
CALL     VDLINL             ;DISPLAY MESSAGE
LD      HL,ENT005           ;ENTRY POINT NAME #5
CALL     VDLINL             ;DISPLAY IT
LD      HL,LRL2ND           ;'SECOND' LOGICAL REC MSG
CALL     VDLINL             ;DISPLAY MESSAGE
LD      HL,WRT001           ;WRITING LOGICAL REC MSG
CALL     VDLINL             ;DISPLAY MESSAGE
RET
MSG006 LD      HL,ENTMSG      ;ENTRY POINT MESSAGE
CALL     VDLINL             ;DISPLAY MESSAGE
LD      HL,ENT006           ;ENTRY POINT NAME #6
CALL     VDLINL             ;DISPLAY IT
LD      HL,LRL3RD           ;'THIRD' LOGICAL REC MSG
CALL     VDLINL             ;DISPLAY MESSAGE
LD      HL,WRT001           ;WRITING LOGICAL REC MSG
CALL     VDLINL             ;DISPLAY MESSAGE
RET
MSG007 LD      HL,ENTMSG      ;ENTRY POINT MESSAGE
CALL     VDLINL             ;DISPLAY MESSAGE
LD      HL,ENT007           ;ENTRY POINT NAME #7
CALL     VDLINL             ;DISPLAY IT
LD      HL,LRL4TH           ;'FOURTH' LOGICAL REC MSG
CALL     VDLINL             ;DISPLAY MESSAGE
LD      HL,WRT001           ;WRITING LOGICAL REC MSG
CALL     VDLINL             ;DISPLAY MESSAGE
RET
MSG008 LD      HL,ENTMSG      ;ENTRY POINT MESSAGE
CALL     VDLINL             ;DISPLAY MESSAGE
LD      HL,ENT008           ;ENTRY POINT NAME #8
CALL     VDLINL             ;DISPLAY IT
LD      HL,LRL5TH           ;'FIFTH' LOGICAL REC MSG
CALL     VDLINL             ;DISPLAY MESSAGE
LD      HL,WRT001           ;WRITING LOGICAL REC MSG
CALL     VDLINL             ;DISPLAY MESSAGE
RET
MSG009 LD      HL,ENTMSG      ;ENTRY POINT MESSAGE
CALL     VDLINL             ;DISPLAY MESSAGE
LD      HL,ENT009           ;ENTRY POINT NAME #9
CALL     VDLINL             ;DISPLAY IT
LD      HL,CLOSMS           ;CLOSING FILE MESSAGE
CALL     VDLINL             ;DISPLAY MESSAGE
RET
MSG010 LD      HL,ENTMSG      ;ENTRY POINT MESSAGE
CALL     VDLINL             ;DISPLAY MESSAGE
LD      HL,ENT010           ;ENTRY POINT NAME #10
CALL     VDLINL             ;DISPLAY IT
LD      HL,RDMMSG           ;READING FILE MESSAGE
CALL     VDLINL             ;DISPLAY MESSAGE
RET
MSG011 LD      HL,ENTMSG      ;ENTRY POINT MESSAGE
CALL     VDLINL             ;DISPLAY MESSAGE
LD      HL,ENT011           ;ENTRY POINT NAME #11
CALL     VDLINL             ;DISPLAY IT
LD      HL,LRL1ST           ;'FIRST' LOGICAL REC MSG
CALL     VDLINL             ;DISPLAY MESSAGE
LD      HL,RDLRL            ;READING LOGICAL REC MSG
CALL     VDLINL             ;DISPLAY MESSAGE
RET
MSG012 LD      HL,ENTMSG      ;ENTRY POINT MESSAGE
CALL     VDLINL             ;DISPLAY MESSAGE
LD      HL,ENT012           ;ENTRY POINT NAME #12
CALL     VDLINL             ;DISPLAY IT
LD      HL,POSMSG           ;POSITIONING MESSAGE

```

Listing continued

Listing continued

```

04840      CALL      VDLINL      ;DISPLAY MESSAGE
04850      RET
04860      MSG#13  LD      HL,ENTMSG      ;ENTRY POINT MESSAGE
04870      CALL      VDLINL      ;DISPLAY MESSAGE
04880      LD      HL,ENT#13      ;ENTRY POINT NAME #13
04890      CALL      VDLINL      ;DISPLAY IT
04900      LD      HL,LRL3RD      ;'THIRD' LOGICAL REC MSG
04910      CALL      VDLINL      ;DISPLAY MESSAGE
04920      LD      HL,RDLRL      ;READING LOGICAL REC MSG
04930      CALL      VDLINL      ;DISPLAY MESSAGE
04940      RET
04950      MSG#14  LD      HL,ENTMSG      ;ENTRY POINT MESSAGE
04960      CALL      VDLINL      ;DISPLAY MESSAGE
04970      LD      HL,ENT#14      ;ENTRY POINT NAME #14
04980      CALL      VDLINL      ;DISPLAY IT
04990      LD      HL,REWMSG      ;REWINDING FILE MESSAGE
05000      CALL      VDLINL      ;DISPLAY MESSAGE
05010      RET
05020      MSG#15  LD      HL,ENTMSG      ;ENTRY POINT MESSAGE
05030      CALL      VDLINL      ;DISPLAY MESSAGE
05040      LD      HL,ENT#15      ;ENTRY POINT NAME #15
05050      CALL      VDLINL      ;DISPLAY IT
05060      LD      HL,LRL1ST      ;'FIRST' LOGICAL REC MSG
05070      CALL      VDLINL      ;DISPLAY MESSAGE
05080      LD      HL,RDLRL      ;READING LOGICAL REC MSG
05090      CALL      VDLINL      ;DISPLAY MESSAGE
05100      RET
05110      MSG#16  LD      HL,ENTMSG      ;ENTRY POINT MESSAGE
05120      CALL      VDLINL      ;DISPLAY MESSAGE
05130      LD      HL,ENT#16      ;ENTRY POINT NAME #16
05140      CALL      VDLINL      ;DISPLAY IT
05150      LD      HL,EOPMSG      ;POSITIONING TO EOP MSG
05160      CALL      VDLINL      ;DISPLAY MESSAGE
05170      RET
05180      MSG#17  LD      HL,ENTMSG      ;ENTRY POINT MESSAGE
05190      CALL      VDLINL      ;DISPLAY MESSAGE
05200      LD      HL,ENT#17      ;ENTRY POINT NAME #17
05210      CALL      VDLINL      ;DISPLAY IT
05220      LD      HL,BKSPMS      ;BACKSPACING MESSAGE
05230      CALL      VDLINL      ;DISPLAY MESSAGE
05240      RET
05250      MSG#18  LD      HL,ENTMSG      ;ENTRY POINT MESSAGE
05260      CALL      VDLINL      ;DISPLAY MESSAGE
05270      LD      HL,ENT#18      ;ENTRY POINT NAME #18
05280      CALL      VDLINL      ;DISPLAY IT
05290      LD      HL,LRL5TH      ;'FIFTH' LOGICAL REC MSG
05300      CALL      VDLINL      ;DISPLAY MESSAGE
05310      LD      HL,RDLRL      ;READING LOGICAL REC MSG
05320      CALL      VDLINL      ;DISPLAY MESSAGE
05330      RET
05340      MSG#19  LD      HL,ENTMSG      ;ENTRY POINT MESSAGE
05350      CALL      VDLINL      ;DISPLAY MESSAGE
05360      LD      HL,ENT#19      ;ENTRY POINT NAME #19
05370      CALL      VDLINL      ;DISPLAY IT
05380      LD      HL,CLOSMS      ;CLOSING FILE MESSAGE
05390      CALL      VDLINL      ;DISPLAY MESSAGE
05400      RET
05410      ;
05420      ;*****
05430      ;      CLEAR BUFFER AREAS
05440      ;*****
05450      ;
05460      CLRBUF  LD      BC,LENGTH      ;LENGTH OF STORAGE AREA
05470      LD      HL,BUFFER      ;START OF STORAGE AREA
05480      CLRLP   XOR      A      ;CLEAR A REGISTER
05490      LD      (HL),A      ;CLEAR STORAGE AREA
05500      OEC      BC      ;DECREMENT BYTE COUNTER
05510      LD      A,B      ;IS CLEARING PUNC. DONE ?
05520      OR      C
05530      INC      NL      ;GO TO NEXT LOCATION
05540      JR      NZ,CLRLP      ;NO, FINISH CLEARING BUFS
05550      RET
05560      ;
05570      ;*****
05580      ;      PROVIDE DUMMY DATA FOR WRITE
05590      ;*****
05600      ;
05610      MOVDAT  LD      DE,UREC      ;ADDRESS OF USER BUFFER
05620      LD      A,0      ;LOOP COUNTER
05630      MOVLP1  LD      HL,LRL#01      ;DATA TO BE MOVED
05640      LD      BC,16      ;NUMBER OF BYTES TO MOVE
05650      LDIR      ;MOVE THEN
05660      DEC      A      ;REDUCE LOOP COUNTER
05670      JR      NZ,MOVLP1      ;FINISH DATA MOVE
05680      LD      A,0      ;LOOP COUNTER
05690      MOVLP2  LD      HL,LRL#02      ;DATA TO BE MOVED
05700      LD      BC,16      ;NUMBER OF BYTES TO MOVE
05710      LDIR      ;MOVE THEN
05720      DEC      A      ;REDUCE LOOP COUNTER
05730      JR      NZ,MOVLP2      ;FINISH DATA MOVE
05740      LD      A,0      ;LOOP COUNTER
05750      MOVLP3  LD      HL,LRL#03      ;DATA TO BE MOVED
05760      LD      BC,16      ;NUMBER OF BYTES TO MOVE
05770      LDIR      ;MOVE THEN
05780      DEC      A      ;REDUCE LOOP COUNTER
05790      JR      NZ,MOVLP3      ;FINISH DATA MOVE
05800      LD      A,0      ;LOOP COUNTER
05810      MOVLP4  LD      HL,LRL#04      ;DATA TO BE MOVED
05820      LD      BC,16      ;NUMBER OF BYTES TO MOVE
05830      LDIR      ;MOVE THEN
05840      DEC      A      ;REDUCE LOOP COUNTER
05850      JR      NZ,MOVLP4      ;FINISH DATA MOVE
05860      LD      A,0      ;LOOP COUNTER
05870      MOVLP5  LD      HL,LRL#05      ;DATA TO BE MOVED
05880      LD      BC,16      ;NUMBER OF BYTES TO MOVE
05890      LDIR      ;MOVE THEN

```

Listing continued

register. The call to Read puts the fifth logical record into the user buffer UREC. A call to Look lets you view the new data in UREC.

With the reading of all the records complete, you can now reenter the program at label CLSENT, where a number of things happen in succession. You first want to close the file. Do so in the same manner in which you built the file, with the DE register pointing to the DCB and by executing a call to Close.

Since you no longer have any use for this file, you can also kill it. The only parameter you need to kill the file is to point the DE register to the DCB and make a call to the Kill routine. A successful kill operation returns the zero flag set.

To verify this, look at the disk directory to see that the directory no longer lists the file name. The subroutine KILL now sets the first 16 bytes of the DCB to zero.

The DSPDIR routine displays the disk directory. It needs only the drive number of the disk from which you want a directory, coded as an ASCII number in location 4271 hex. If you remember, you put the drive number in the location DRVNUM. Picking it up here and moving it to 4271 hex, followed by a call to DSPDIR, verifies that you killed TESTFILE/TST. The directory listing is abbreviated, showing only file names.

Now return to the demonstration program. Here, two messages indicate that you've closed and killed the file. Immediately following this, the program clears the screen and displays the directory.

Enter any character following the directory display to terminate the demonstration program with a jump to the TRSDOS entry point JP2DOS.

Two routines not covered in this program are VERF and CMDDOS. VERF is the same as Write except that after each write to disk, VERF reads the data to verify a proper write.

CMDDOS is similar to COMDOS except CMDDOS returns to the user's program after completing the routine. Of course, if you execute one of your programs from another program using this command, you must execute a final return to ensure that you make it possible to return. All the routines just covered are limited to accessing user generated files only. No system files are accessible. ■

Write to David G. Haan at 4361 S. Estes St., Littleton, CO 80123.

Listing continued

```

05100      DEC      A      ;REDUCE LOOP COUNTER
05110      JR      NZ,MOVLPS ;FINISH DATA MOVE
05120      RET
05130      ;
05140      ;*****
05150      ;      MESSAGES
05160      ;*****
05170      ;
05180      SIGNON  DEFB      'ASSEMBLY LANGUAGE DISK I/O '
05190      DEFB      'FOR THE TRS-80 MODEL III.'
05200      DEFB      0DH
05210      SPCMSG  DEFB      'ENTER FILENAME.'
05220      DEFB      0DH
05230      LKMSG  DEFB      'DO YOU WISH TO LOOK AT ANY DATA?'
05240      DEFB      0DH
05250      LRL001  DEFB      'LRL NUMBER ONE. '
05260      LRL002  DEFB      'LRL NUMBER TWO. '
05270      LRL003  DEFB      'LRL NUMBER THREE '
05280      LRL004  DEFB      'LRL NUMBER FOUR '
05290      LRL005  DEFB      'LRL NUMBER FIVE '
05300      EXTMSG  DEFB      'ENTER 3 CHARACTER EXTENSION (E.G. TST).'
05310      DEFB      0DH
05320      OPNMSG  DEFB      'ATTEMPTING TO OPEN FILE.'
05330      DEFB      0DH
05340      INITMS  DEFB      'INITIALIZING NEW FILE.'
05350      DEFB      0DH
05360      LRL1ST  DEFB      'FIRST '
05370      DEFB      03H
05380      LRL2ND  DEFB      'SECOND '
05390      DEFB      03H
05400      LRL3RD  DEFB      'THIRD '
05410      DEFB      03H
05420      LRL4TH  DEFB      'FOURTH '
05430      DEFB      03H
05440      LRL5TH  DEFB      'FIFTH '
05450      DEFB      03H
05460      WRT001  DEFB      'LOGICAL RECORD BEING WRITTEN.'
05470      DEFB      0DH
05480      CLOSMS  DEFB      'CLOSING FILE.'
05490      DEFB      0DH
05500      RDMSG  DEFB      'THIS SECTION WILL INVOLVE '
05510      DEFB      'READING RANDOM LOGICAL RECORDS.'
05520      DEFB      0DH
05530      RDLRL  DEFB      'LOGICAL RECORD BEING READ.'
05540      DEFB      0DH
05550      POSMSG  DEFB      'POSITIONING TO THIRD LOGICAL RECORD.'
05560      DEFB      0DH
05570      BKSPMS  DEFB      'BACKSPACING ONE LOGICAL RECORD.'
05580      DEFB      0DH
05590      DRVMSG  DEFB      'FILE EXISTS ON DRIVE '
05600      DEFB      0
05610      DEFB      0DH
05620      FILMSG  DEFB      'FILE NUMBER IS '
05630      DEFB      0
05640      DEFB      0DH
05650      RENMSG  DEFB      'REWINDING FILE.'
05660      DEFB      0DH
05670      EOPMSG  DEFB      'POSITIONING TO END OF FILE.'
05680      DEFB      0DH
05690      KILMSG  DEFB      'KILLING FILE.'
05700      DEFB      0DH
05710      ENDMMSG DEFB      'END OF DEMONSTRATION PROGRAM...'
05720      DEFB      'PRESS ANY KEY TO CONTINUE.'
05730      DEFB      0DH
05740      ENTHSG  DEFB      'REENTRY POINT IS AT PROGRAM LABEL '
05750      DEFB      03H
05760      ENT001  DEFB      'EXTEND.'
05770      DEFB      0D9AH
05780      ENT002  DEFB      'OPNFIL.'
05790      DEFB      0D9AH
05800      ENT003  DEFB      'NEWFIL.'
05810      DEFB      0D9AH
05820      ENT004  DEFB      'WRTFIL.'
05830      DEFB      0D9AH
05840      ENT005  DEFB      'WRT002.'
05850      DEFB      0D9AH
05860      ENT006  DEFB      'WRT003.'
05870      DEFB      0D9AH
05880      ENT007  DEFB      'WRT004.'
05890      DEFB      0D9AH
05900      ENT008  DEFB      'WRT005.'
05910      DEFB      0D9AH
05920      ENT009  DEFB      'CLOSFL.'
05930      DEFB      0D9AH
05940      ENT010  DEFB      'CTSPCL.'
05950      DEFB      0D9AH
05960      ENT011  DEFB      'READ01.'
05970      DEFB      0D9AH
05980      ENT012  DEFB      'POSENT.'
05990      DEFB      0D9AH
06000      ENT013  DEFB      'READ02.'
06010      DEFB      0D9AH
06020      ENT014  DEFB      'REWEKT.'
06030      DEFB      0D9AH
06040      ENT015  DEFB      'READ03.'
06050      DEFB      0D9AH
06060      ENT016  DEFB      'EOPENT.'
06070      DEFB      0D9AH
06080      ENT017  DEFB      'SEENT.'
06090      DEFB      0D9AH
06100      ENT018  DEFB      'READ04.'
06110      DEFB      0D9AH
06120      ENT019  DEFB      'CLSENT.'
06130      DEFB      0D9AH
06140      EXECUT  DEFB      'DEBUG'
06150      DEFB      0DH
06160      END      START

```

SERIAL PORT EXPANDER AND MORE



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✓ 59

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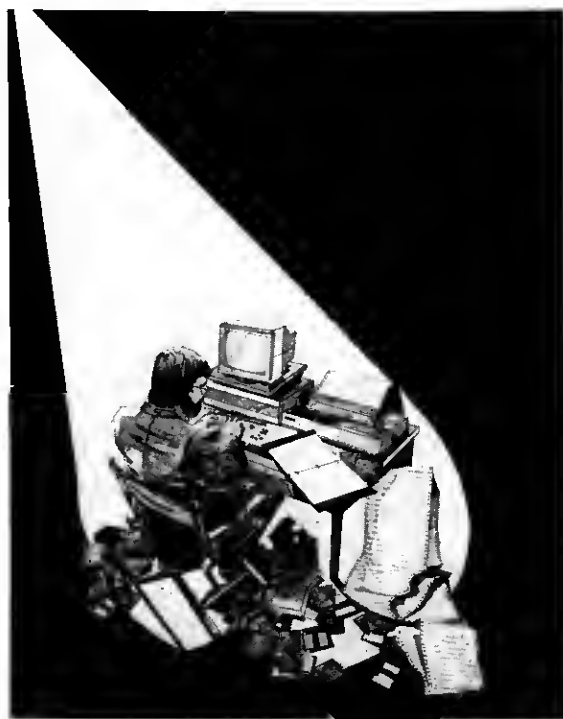
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The PRODUCER has proven to be the greatest. I used to spend 70% of my time writing programs to create, maintain, sort, and list data. No More. Days and weeks of programming are now reduced to minutes and hours. The PRODUCER has increased the productivity of my custom software firm by 400%. This product is in a class reserved for the best.

A. Copelle, Northbrook, Illinois.

HOW DO I LEARN TO USE THE PRODUCER

In each TRS-80 version, we have provided a systematic guided tour of The PRODUCER program generator process. For the Model I and III, an audio cassette tape tutorial is part of your package. One of your fellow PRODUCER owners talks to you as you go through the step-by-step lessons. The tapes not only teach you the operating process, they enable you to actually create a program of your own design while you learn.

We have provided over 200 pages of thorough documentation in The PRODUCER Reference Manual, but we encourage you not to read the manual until after you have completed the tutorial. We've had many rave reviews from our users, like this one from S.R. Foster of Pensacola, Florida:

The tutorial was an excellent starter. It enabled me to get on with it without days and days of reading. Very helpful.

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You will be impressed with the professionalism of the PRODUCER package:

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Pictured are the components of the Model III version of The PRODUCER. Other versions may vary slightly.



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HOW THE PRODUCER WORKS

We think you will be impressed with the ease of operation and the amazing versatility of features you get with the PRODUCER. Here is a step by step overview of the program writing process. The screen shown is an unretouched photo of the Master Menu from which each of these steps is selected.

☐ Planning Your Program

The PRODUCER provides a helpful planning form you can print on your own printer. It helps you organize your thoughts to create a tailor made program to meet your needs.

☐ Creating The Screen

Visible on your monitor will be the screen where information will be entered, edited and displayed. There are six simple steps to follow in creating your screen.

1. Draw Your Screen

Using the arrow keys construct the screen in any configuration you desire. With single keystrokes, enter large graphic letters and borders. Edit at will until you are satisfied.

2. Define Message Areas

Select an area of your screen where The PRODUCER messages to you will appear.

3. Deline Input Fields

The PRODUCER will ask you questions about the areas where you will enter the data. You specify the length of each area or field, as well as acceptable characters in each field.

4. Deline Display Fields

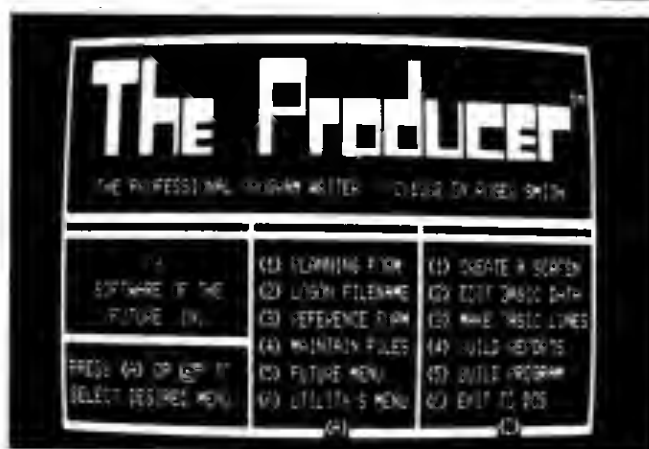
Locate the display fields anywhere you want on your screen. These show the results of the calculations you want made on your data.

5. Define Custom Prompts

You select an area where help messages to yourself can be displayed.

6. Save Your Results

Assign a working name for your program and save it to disk.



☐ Editing Basic Data

1. Edit any part of The PRODUCER program you have created -- screen field names, lengths, prompt areas, etc.
2. Type in any help message you want as a custom prompt to help you operate the program.
3. Easily create calculations for your program using actual field names. You can use the contents of any numeric field and all math operations including logical operators.

☐ Making Basic Code

Press a key, sit back and watch The PRODUCER do all the work of creating BASIC code for your program. You can see the program lines appear on your screen. Complete error checking is done for you.

☐ Building Reports

Virtually any report is available to you thru our NEW free form report generator. It works with any size paper. You are allowed up to 100 calculations within the report. You can specify exact position of any text information to any position on your paper (even preprinted forms, checks, etc.). An amazingly versatile tool.

☐ Building The Program

Put the finishing touches on your program by selecting cursor type, size, flashing speed, auto messages, custom logos, etc. After your selections have been made, press a key and your entire finished program is created in less than 5 minutes. That's all there is to this remarkably simple program generation process.

Continued

TECHNICAL INFORMATION

The PRODUCER provides many advanced features which allow you to do "magic" with the programs you create

The SCREEN GENERATOR

- *Use the full screen (all lines and column positions)
- *Create a professional well organized screen with graphics
- *Save up to 9 separate screens in memory at one time and get instant access to each
- *Move the cursor to any location on the screen
- *Replicate bars/lines/graphics to define certain screen areas
- *Access an instantly available Help Menu of all Screen Editor commands
- *Insert and delete any character with a single keystroke
- *Clear or erase selected areas of any screen
- *Insert and delete whole lines on the screen
- *Center any text on the screen
- *Move any rectangular block of text anywhere on the screen (block move)
- *Create titles with a single keystroke large graphic letter alphabet
- *Move portions of screens between different screens (cut and paste)
- *Save any number of screens to disk at any time
- *Recall any screen from disk any time
- *Create BASIC lines to re-create any screen

FILE and RECORD HANDLING

- *Rapidly access records with BTREE File structure
- *Search for a record with only the first few letters of the name or key (partial key) (Example locate PRODUCER by typing PR)
- *Recall and edit duplicate and multiple keys (Example Several last names may be the same on a file and you can find and edit them individually)
- *Fully edit any part of a previously entered record
- *Recover unused space automatically upon deletion of a record
- *Enter data very fast with the special batch mode
- *Recall immediately any record after it's been entered, eliminating time consuming sorting and indexing
- *Rapidly access any record anytime (2-4 seconds average)
- *Globally search and replace data in certain fields in selected record range
- *Automatically rebuild any file to meet new specifications. No need to re-enter data when a file needs to be restructured.
- *Balance any BTREE file automatically to reorganize and speed up file access time
- *Recover from power failure and easily rebuild files that have been damaged. Avoid laborious re-entry of long data files

SCREEN ORIENTED INPUT and EDITING of DATA

- *Insert and delete characters at any position in any field. No "back to start" retyping of data
- *Move forward or back to previously entered fields to edit using the arrow keys. Totally non-destructive cursor. Does not require re-entering of each data field
- *Move within any field using the arrow keys
- *Move instantly to any field with Control G command
- *Exit from input/edit mode at any point allowing immediate escape from data entry mode. Allows partial information to be entered for each record without the annoying, time consuming need to press ENTER for each blank field not used at the time of entry
- *Duplicate field information from a previous record with one keystroke. No need to re-enter duplicate information, addresses, etc. on consecutive records
- *View a custom prompt, your own custom reminder or help message for each field with 1 keystroke
- *Verify each character typed automatically
- *Enter data as fast as you want, even if you are a speed typist
- *View visible display of automatic field length restrictions
- *View prompts for each field showing number of characters allowed

PRINTED REPORTS

- *Create up to 9 separate reports at a time in a finished program
- *Generate any number of reports you want (no limit)
- *Select reports by name from a report menu in the program
- *Select from six different automatic report formats including custom mailing labels
- *Instantly print reports by key with no time consuming sort necessary
- *Sort and print any other (non key) field with the fast machine language sort
- *Sort only records that meet your search criteria
- *Sort on more than one field if desired
- *Use any restrictions or search criteria to determine which records will be included in a report
- *Use any number of multiple search criteria (including logical) (Example. You can search for all the males who are single, and drive a car that are over 24 years old but less than 35 years old)
- *Send any special command to your printer before or after any report
- *Specify any line length needed and any page length desired
- *Select single line or multiple lines per record, even one page per record
- *Total any fields during the report (running totals)

FREEFORM REPORT GENERATOR

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- *Specify column and row of every heading and field
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- *Put any field anywhere on the page. No limitations

ADVANCED CALCULATIONS

- *Globally recalculate any field in any or all records (Example: If file is a list of gold assets and the spot price changes, each separate asset may be recalculated with a new value for the spot price)
- *Use all math operations including exponentiation and trigonometry
- *Use logical calculations such as And, Or, Not, etc.
- *Use any level of parenthesis in calculation formulas
- *Save results in any field and display results in any field
- *Store temporary results in several extra memory slots
- *Pass calculation results between records
- *Determine the exact order of calculations
- *Display or save results at your option in the finished record

OTHER ADVANCED FEATURES

- *Edit any part of any program without starting over or redefining the entire program
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We continue to receive testimonials from satisfied users almost every day. Here's a sampling of the feedback we are receiving:

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S. R. Foster, Pensacola, Florida

I think the PRODUCER will save me so much time that it will give me the time to do the more important tasks that my business calls for and the money I'll save from not having to buy canned programs that are overpriced. Now with the PRODUCER I can write a program overnight to do almost anything I want it to do and with written reports to boot. Talk about saving time and money. I feel the PRODUCER will pay for itself with my first three programs.

S. Tornatore, Canastota, New York

The PRODUCER is a very impressive software package. It is well worth the money. While other micro owners are printing mailing labels, I am now selling them programs to use. I now have more time to spend enjoying my computer.

V. E. Ryberg, Bloomington, Illinois

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R. Selsback, Burlingame, California

It was very complete and professionally done. The packaging and program seem to have been thought out before assembly and sale. The 'value' of the deal, everything included was the best I've seen to date.

G. Slusher, Martin, Kentucky

Very professional packaging. It gave the feeling of getting your money's worth before even running the program...Very easy to use and leaves very few questions unanswered...As you can see, I like the PRODUCER and was impressed with how trouble free it is.

A. C. Vincent, Napa, California

Excellent. Above and beyond other software.

R. Hapgood, Henrietta, Texas

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The PRODUCER is the best all purpose program generator I have used. (We have tried almost all of them.) The generated code is bug free, well commented and efficient.

R. A. Copella, Northbrook, Illinois

I bought the PRODUCER to save time. I feel capable of being able to write almost all programs I need. The PRODUCER generated programs will save a lot of time writing basic code and debugging. Using the PRODUCER I can write a good database type program using math calculation in about three hours. I don't have to tell you how long it would take writing the same program from scratch.

S. Tornatore, Canastota, New York

A special thanks to Roger and all of you. You've made my computing life easier and better. My 10 year old can't wait to get his hands on the PRODUCER.

J. D. Konkler, Columbus, Ohio

DOCUMENTATION

The Reference Manual is a work of art. Not only is it attractive and easy to use, it is so well organized, documented and logically written that the manual is a rarity in the software market place.

S. R. Foster, Pensacola, Florida

One of the best I've seen. We write about 20 volumes of material per year. Take it from a 'pro', it's good!

J. Crespi, Sherman Oaks, California

The PRODUCER Reference Manual is professionally written to provide ready access to easily understood answers to questions which arise during use of the PRODUCER.

R. A. Copella, Northbrook, Illinois

The Reference Manual is supreme and superior to anything I have worked with.

R. A. Neuman, Okemos, Michigan

Very well laid out and organized. One of the best I've seen.

J. D. Konkler, Columbus, Ohio

QUALITY

Thank you for an excellent program. I agree that The PRODUCER will change the entire concept of program creation in the future. But for now, you stand as the best data-base-management-system I can buy.

E. Sung, Vancouver, B.C.

Your system really is Software of the Future. Your staff has insight others of us only dream of. Congratulations on a product of extraordinary design.

S. R. Foster, Pensacola, Florida

This is an excellent program. At this point I am totally pleased. This is by far my number one software and I will use it anywhere and everywhere I possibly can both personal and business. Once again congratulations to all of the people involved.

R. A. Neuman, Okemos, Michigan

Comparison shopping indicates the PRODUCER's superiority to all others. And I already own most of the others.

R. A. Copella, Northbrook, Illinois

Glad to see you take an interest in what some of us hackers are up against. I think the PRODUCER will make the software hackers upgrade their products to this high level quality of the PRODUCER. I'm sure you realise that there is a lot of garbage on the market.

D. J. Smith, Lombard, Illinois

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W. J. Mahaffey, Absecon, N. J.

USE

The program is almost idiot proof.

J. Crespi, Sherman Oaks, California

It is a very friendly friend and we will be working together for some time to come.

R. A. Neuman, Okemos, Michigan

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Both programs run on the Models II.

An example of this searching technique is that employed by a slow-witted detective who has a telephone number and needs to find the name and address of the person who leases the telephone line. The detective gets a telephone book, starts at page one, and compares every telephone number with the one he is searching for until he finds the exact number.

In this search technique, each record has a number of attributes (secondary keys), each of which has only two possible values: yes or no (true or false). Given a set of attributes, you can find all the records with these attributes by

110 • 80 Micro, December 1983

Figure 1. Edge-notched card for suspect Bugsy Moran.

comparing corresponding true and false values.

Our detective has a list of 200 suspects in a case on which he is working, and has the following information on each suspect: criminal record, military service, college education, IRS audit, alibi at time of crime, United States citizen, relative of victim, history of alcohol abuse, and motive for the crime. He wants to find all suspects who have a criminal record, no alibi, and a motive.

He goes to his local stationery store, purchases edge-notched cards, and codes them as shown in Fig. 1. Each attribute has a hole at the edge of the card. If an attribute is true, a notch is cut out of the card next to the attribute; otherwise the hole is left intact.

In Fig. 1, you can see that Bugsy Moran has a criminal record, no alibi, and a motive. Our detective makes his search in the following way: He arranges all 200 cards in a deck and puts a needle through the holes for the alibi attribute, then lifts the deck by raising the needle. All records of suspects with alibis fall out of the deck and he can exclude them.

Automobile Model	Notch Code
Buick	99 21
Cadillac	54 83
Chevrolet	41 78
Chrysler	07 31
DeSoto	67 81
Dodge	46 15
Edsel	66 10
Ford	73 09
Hudson	32 77
Lincoln	28 41
Mercury	12 88
Nash	34 89
Oldsmobile	59 42
Packard	44 75
Pontiac	74 28
Plymouth	57 71
Rambler	93 14
Rolls Royce	61 85
Studebaker	01 94
Volkswagen	57 39

Automobile Color	Notch Code
Black	40 74
Blue	02 77
Brown	04 14
Chartreuse	15 80
Gray	69 52
Green	23 94
Maroon	29 44
Red	39 15
White	70 96
Yellow	59 20

Table 1. Superimposed notch codes for automobile model and color.

The detective takes the cards that didn't fall out and puts needles into the holes for the criminal history and motive attributes. When he lifts the needles, all records of suspects with a criminal past, no alibi, and a motive for the crime fall out. This amounts to 10 cards; he has narrowed his search to 10 out of 200 suspects.

You can consider the holes and notches in the edge-notched card as a string of bits. For any attribute, the bit is either zero (the hole is intact) or 1 (the card has a notch). The attribute bit string of each record is called the record's signature and is an index of the

record's attributes.

Binary Attribute Search of Superimposed Codes

This technique is similar to the simple binary attribute search except that the signature has more attributes than bits. The principle is to map a set of m binary attributes from a record into a set of n codes, then superimpose the codes for each attribute onto an n -bit signature.

Our detective is so enamored with his success in pruning his suspect list, he decides to use edge-notched cards for another purpose. In his state, automobile license numbers comprise three two-

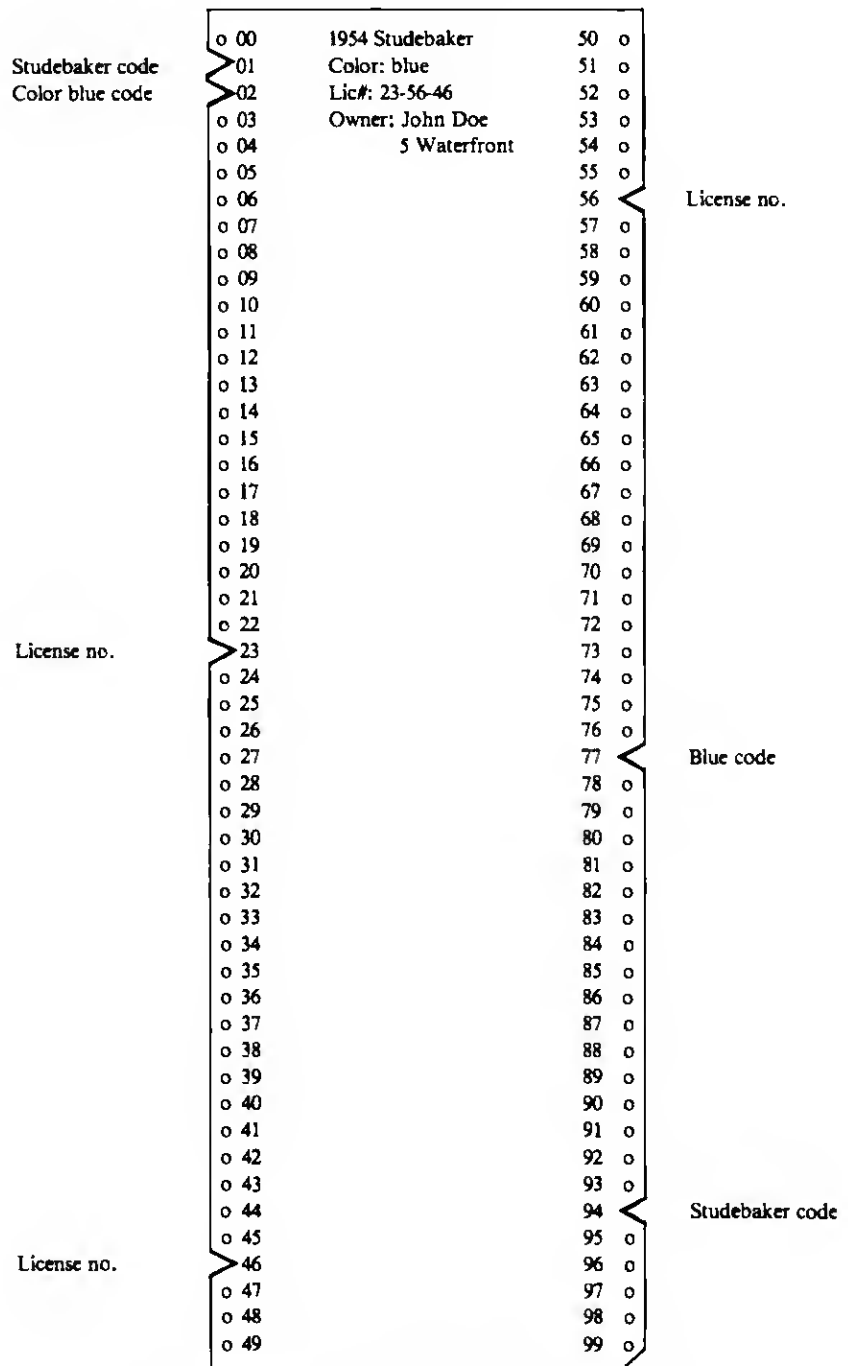


Figure 2. Edge-notched card for a blue Studebaker with license number 23-56-46.

digit numbers (72-54-81). There are one million possible license numbers.

Often, a witness to a crime remembers only one or two of the pairs of digits, so our detective devises a method that lets him quickly determine the owner of a vehicle when he knows only part of a license number.

He buys cards with 100 holes and uses the following coding technique: He numbers the holes in the card zero to 99. For each pair of digits in the license number, he makes a notch corresponding to the number in the appropriate card hole (Fig. 2). Additionally, he codes 20 models and 10 car colors as

shown in Table 1.

The detective obtains a registration list from the Department of Motor Vehicles (DMV) and starts to code all the information about 200,000 automobiles in his city onto cards. One year later, just as he finishes his task, he gets a call from a client whose TRS-80 was stolen.

The client saw the get-away car (a blue Studebaker) drive off, but could read only the first and last pairs of digits from the license plate. The DMV computer is broken so the police can't search the motor vehicle registry data base until tomorrow, but the client needs his computer today.

The detective takes his cards, puts them in a neat deck, then places very long needles through the holes corresponding to the digit pairs 46 and 23, the color blue, and the automobile model Studebaker. Three cards fall out of a deck of 200,000 cards. The detective sequentially searches the three cards and finds that only two are Studebakers. He has narrowed his search from 200,000 to two.

Both Studebakers are blue: one with license number 46-79-23 and the other 23-46-42. The model and color codes are the same and the detective specified only two of the three possible two-digit numbers from the license (23 and 46), so the signatures of both automobile records fit the search.

But why did the third car, a green Dodge, also fall out? The code for the color green is 23 94 and the code for the model Dodge is 46 15. The green Dodge that fits the search key had license number 77-01-02. The notches in the card (23, 94, 46, 15, 01, 02, 77) corresponded to every needle placed in the deck (Fig. 3), so the card fell out along with the two Studebaker cards.

The detective used a primitive coding scheme. Elaborate methods have been developed for both edge-notch cards and bit-string computer searches. Signature screening, which you'll use to search text files, is a variation on the method the detective employed.

Tree Search

In tree searching techniques, records are arranged in some order (numerical, alphabetical, and so on). Either the records within the data file are ordered, or a separate index file contains ordered information (keys) that points to the appropriate records in a file.

You start searching anywhere in the file. If your search key doesn't match a record key, you move your search closer to the beginning or end of the file depending on whether the search key is greater or less than the key of the record just searched.

As an example of this searching technique, consider the slow-witted detective. This time he has a suspect's name (John Smith) and wants to know where the suspect lives. Since names in the telephone book are ordered (sorted alphabetically), the detective uses the following search algorithm.

He opens the telephone book to the middle and finds names beginning with the letter K. He knows that the letter S is between K and Z, so he divides the remaining pages in half and finds names beginning with R. One more division

License no.	o 00	1952 Dodge	50 o	
	o 01	Color: green	51 o	
License no.	o 02	Lic#: 77-01-02	52 o	
	o 03	Owner: John Smith	53 o	
	o 04	5 Dock St.	54 o	
	o 05		55 o	
	o 06		56 o	
	o 07		57 o	
	o 08		58 o	
	o 09		59 o	
	o 10		60 o	
	o 11		61 o	
	o 12		62 o	
	o 13		63 o	
Dodge code	o 14		64 o	
	o 15		65 o	
	o 16		66 o	
	o 17		67 o	
	o 18		68 o	
	o 19		69 o	
	o 20		70 o	
	o 21		71 o	
Green code	o 22		72 o	
	o 23		73 o	
	o 24		74 o	
	o 25		75 o	
	o 26		76 o	
	o 27		77 o	
	o 28		78 o	
	o 29		79 o	
	o 30		80 o	
	o 31		81 o	
	o 32		82 o	
	o 33		83 o	
	o 34		84 o	
	o 35		85 o	
	o 36		86 o	
	o 37		87 o	
	o 38		88 o	
	o 39		89 o	
	o 40		90 o	
	o 41		91 o	
	o 42		92 o	
	o 43		93 o	
	o 44		94 o	
Dodge code	o 45		95 o	
	o 46		96 o	
	o 47		97 o	
	o 48		98 o	
	o 49		99 o	

Figure 3. Edge-notched card for a green Dodge with license number 77-01-02.

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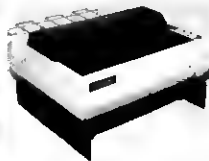
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and search, and he finds names beginning with T.

He continues his search in the opposite direction, and after five more divide-and-search sequences he locates 25 John Smiths. The detective could have made his search more efficient if he had used information he already possessed: his knowledge that names beginning with S are closer to the back of the telephone book than to the front.

The many different tree searching techniques include binary searches, indexed sequential access methods, and so on. All require that the information you're searching for have some order so that comparisons between a search key and a record key determine in which direction the search branches (toward the beginning or end of a file).

Hash Search

In hash searching techniques, you can store the source file records in any order. The hash searching program performs a sequence of mathematical operations (hash functions) on the search key, and produces a value that points to the appropriate record.

The detective has decided that he must use high technology to keep up with the competition. He buys a Model 12 and a 12-megabyte hard disk drive, has a data-entry clerk type all the infor-

mation from the telephone directory into one large file, then hires a high school student to write a data retrieval program that quickly searches the file by name, number, or address.

The student realizes that sequential search techniques are too slow and that Microsoft Basic doesn't support ISAM files. She writes a program to convert every name into a code that indicates where the program stores the record in the file.

The hash function is simple: The ASCII values of the characters comprising an individual's name are multiplied together, then divided by 200,001. The remainder of the division is the record number at which the program stores the name, address, and telephone number. Formally,

$$h(k) = (\prod_{i=1}^n a_i) \bmod 200,001$$

where h is the hash function, k is the key

Because the program listings in this article are so long, we had to print them at a size smaller than usual. We apologize for any inconvenience this causes.

To buy these programs on disk, see the ordering instructions on p. 204.—Eds.

(in this case the person's name), n is the number of letters in the person's name, and a_i is the ASCII value of the i th character in the person's name. $\prod$ is the product $a_1 \cdot a_2 \cdot \dots \cdot a_n$ and mod is the modulus of the quantity in parentheses (the remainder after the number in parentheses is divided by 200,001).

The student finishes her task and goes away for summer vacation. The detective needs to find the address of James Joyce. He sits down at his computer and types in the search key, "James Joyce". Instantly a name, telephone number, and address appear on the video display. Unfortunately, the name is Joyce James, not James Joyce. Our detective has experienced a collision—two distinct record keys hashed to the same number.

The detective is disappointed and afraid that he'll have to use the telephone book. Then he notices a message at the bottom of the screen: "Press N for next record". He presses N. The computer pauses for a brief moment and displays the name James Joyce. The student incorporated a collision-handling routine into her program.

Signature Screening

Tree and hash searching methods are appropriate for records that contain specific fields (name, address, tele-

```
Ln 1      Source Line
00001      ;MINDEX2/SRC...1.2
00002      ;Mac 05, 1983
00003      ;-----
00004      ;MINDEX INDEXING PROGRAM FOR MODEL II
00005      ;MASTER SECTION: links main program with Model II I/O routines
00006      ;and general purpose routines
00007      ;COPYRIGHT 1983, SOFTSHELL CORPORATION ALL RIGHTS RESERVED
00008      ;-----
00009      ;MODII PSECT      ;begin relocatable program section
00010      ;-----
00011      START      JF      BEGIN      ;BEGIN = start of M3
00012      LINK      'M3/REL'
00013      ;main program
00014      ;note: the program is called M3 because it
00015      ;was originally developed on Model III
00016      ;in its current form it will work with
00017      ;Model II or III given the proper I/O
00018      ;module
00019      ;general programs
00020      ;Model II I/O routines
00021      ;-----
00022      LINK      'GR/REL'
00023      LINK      'MODII/REL'
00024      END      START
```

Program Listing 1. Assembly-language listing of Mindex2/SRC.

```
Ln 1      Source Line
00001      ;SEARCH2/SRC...1.2
00002      ;Mac 05, 1983
00003      ;-----
00004      ;SEARCH INDEXING PROGRAM FOR MODEL II
00005      ;MASTER SECTION: links M3, GR, S3OPEN, S3DSP, S3OPT and MODII
00006      ;COPYRIGHT 1983, SOFTSHELL CORPORATION ALL RIGHTS RESERVED
00007      ;-----
00008      ;MODII PSECT      ;begin relocatable program section
00009      ;-----
00010      ;-----
00011      START      JF      BEGIN      ;BEGIN = start of S1
00012      LINK      'S1/REL'
00013      ;SEARCH program proper
00014      ;note: the program is called
00015      ;S1 because it was originally
00016      ;developed on the Model III
00017      ;in its current form it will
00018      ;work with Model II or III
00019      ;given the proper I/O module
00020      ;general routines
00021      ;SEARCH open files routine
00022      ;SEARCH display
00023      ;SEARCH options
00024      ;Model II I/O routines
00025      ;-----
00026      LINK      'GR/REL'
00027      LINK      'S3OPEN/REL'
00028      LINK      'S3DSP/REL'
00029      LINK      'S3OPT/REL'
00030      LINK      'MODII/REL'
00031      END      START
```

Program Listing 2. Assembly-language listing of Search2/SRC:1.

Program Listing 3. Assembly-language listing of MODII/SRC.

```
Ln 1      Source Line
00001      ;MODII/SRC VERSION 1.2
00002      ;Jun 21, 1983
00003      ;-----
00004      ;MODII PSECT      ;Model II I/O routines
00005      ;-----
00006      ;MAP MODII ROUTINES, BUFFERS AND PARAMETERS
00007      ;COPYRIGHT SOFTSHELL 1983 ALL RIGHTS RESERVED
00008      ;-----
00009      ;MODII PSECT      ;begin relocatable program section
00010      ;-----
00011      ;-----
00012      ;public routines
00013      ;-----
00014      PUBLIC BOTTOM      ;position cursor to last line of screen
00015      PUBLIC CLOSE      ;close file (DE->DCB, HL->recd buf)
00016      PUBLIC CURPOS      ;determine cursor pos (coord:BC)
00017      PUBLIC DISBRK      ;disable break (for Model II)
00018      PUBLIC DIVIDE      ;divide A into HL
00019      PUBLIC DSKCMD      ;I/O to TRSDOS and execute command
00020      PUBLIC ERASEL      ;erase to end of line
00021      PUBLIC ERASES      ;erase to end of screen
00022      PUBLIC ERRDISP      ;MAP error display routine
00023      PUBLIC HOME      ;position cursor to top line of screen
00024      PUBLIC INIT      ;initialise file (create/open, pos to last rec)
00025      ; (DE->DCB, HL->recd buf)
00026      ;-----
00027      PUBLIC JF2DOS      ;I/O to TRSDOS
00028      PUBLIC KBRAR      ;get char (or null) from keyboard
00029      PUBLIC KBRMT      ;initialise keyboard (Mod II)
00030      PUBLIC KBLIN3      ;get line from keyboard and end with 03
00031      PUBLIC KBLINE      ;get line from keyboard and end with 0DH
00032      PUBLIC KWAIT      ;wait for char from keyboard
00033      PUBLIC KEYST      ;get scratch key(s) from keyboard
00034      PUBLIC MOVELS      ;move line from screen to buffer
00035      ;HL->buf, D=>no, char, RC=>cursor coord
00036      ;multiply routine
00037      PUBLIC NEWLA      ;role screen and pos cur to next to last line
00038      PUBLIC OPEN      ;open file (DE->DCB, HL->record buffer)
00039      PUBLIC OPINIT      ;open and initialise file
00040      ; (DE->DCB, HL->record buffer)
00041      PUBLIC POSCUR      ;position cursor (coordinates in BC)
00042      PUBLIC POSROP      ;position to end of file
00043      PUBLIC POSR      ;position to record in file
00044      PUBLIC PRINT      ;initialise printer
00045      PUBLIC PRLNBUF      ;print line (HL->buf, D=>no, char, C=>end char)
00046      PUBLIC PRSCRN      ;print entire screen
00047      PUBLIC PRTRLN      ;print last line of text
00048      PUBLIC PTRREC      ;print current record
00049      PUBLIC PTYS      ;point to file spec in end line
00050      PUBLIC READER      ;read file direct access
00051      PUBLIC READNX      ;read next record in file
00052      PUBLIC SCRPMX      ;set scroll protect line (A=>line no.)
00053      PUBLIC SETLKA      ;set ILMK to true last record
00054      PUBLIC SETMLA      ;set MAPLKA to true last record
00055      PUBLIC STEND      ;store top of memory in MEMEND
00056      PUBLIC VDCBAP      ;display char in A register
00057      PUBLIC VDCS      ;clear screen
00058      PUBLIC VDIRIT      ;initialise video I/O (for Model II)
00059      PUBLIC VDLIN3      ;display line (HL->msg; don't print ADH)
00060      PUBLIC VDLINE      ;display line (HL->msg)
00061      PUBLIC WPMWMT      ;word processor wait routine
00062      PUBLIC WRITL      ;direct write routine
00063      PUBLIC WRITNX      ;write next record to file
```

Listing 3 continued

String	He ran down the lane						
Triplets	ran	dow	own	the	lan	anc	
Hash value	181	185	101	191	83	108	

String	Jill walks up the lane						
Triplets	jil	ill	wal	alk	lks	the	lan anc
Hash value	212	142	177	94	188	191	83 108

String	The goat ran up the lane						
Triplets	The	goa	oat	ran	the	lan	anc
Hash value	191	212	138	181	191	83	108

Table 2. Three strings, their corresponding triplets, and hash values.

phone number, and so on). Text, however, does not lend itself readily to such indexing, and many text searching programs still employ sequential search techniques.

In 1971, M.C. Harrison proposed a method to speed up searching large text files ("Implementation of the Substring Test by Hashing." Comm. Assoc. Computing Machinery. 14:777-779, 1971). The idea is simple: Before searching a string of text for a particular key, perform a quick screening test to determine whether the key is not present or possibly present.

If the test determines that the key isn't present in a string, you don't need to search that string. If the test is positive (the string might be present), a sequential search determines if the key is actually present in the string. I refer to this method as signature screening.

The following method is an extension of that which Harrison proposed. It's designed for use on 8-bit machines that read 256-byte disk sectors. Each record consists of a string of ASCII characters.

The search program considers every three sequential characters (triplet) of a string as attributes of the string. The program ignores triplets containing one or more spaces. For example, the string "Jack ran up the hill" has the following attributes: "Jac", "ack", "ran", "the", "hil", and "ill".

Considering only letters of the alphabet, you can have 26³ or 17,576 possible attributes for any triplet of letters A through Z. The 17,576 possible attributes (triplets) are mapped onto a 251-bit string. A hashing function reduces the 17,576 attributes to 251 values (zero to 250).

The hash function, h , for any triplet is:

$$h(c_1, c_2, c_3) = (100a(c_1) + 10a(c_2) + a(c_3)) \bmod 251$$

where c_1 , c_2 , and c_3 represent the first,

second, and third characters of the triplet respectively, and a represents the ASCII value of any character. Any uppercase letter is assigned the same value as the corresponding lowercase letter. The mod is the modulus of the quantity in parentheses (the remainder) after the number in parentheses is divided by 251. If any triplet has one or more blank characters in it, it has no hash value.

The word "hill" has two triplets. You want to find the hash value of the first triplet, "hil". The ASCII values of "h", "i", and "l" are 104, 105, and 108, respectively.

First multiply 104 by 100, 105 by 10, and 108 by 1. Then add the three numbers (11,558) and finally divide 11,558 by 251. The remainder, 12, is the value of the hash function for the triplet hil.

The hash function has several features that are important when indexing text. The order in which letters are arranged in a triplet determines the hash value. Triplets such as "tab" and "bat" do not hash to the same value.

Spaces, which often consume a considerable portion of text, aren't included so the program indexes only words of three or more characters. This avoids indexing many meaningless triplets. In the string "boy and girl", the program hashes and indexes only the triplets "boy", "and", "gir", and "irl". The triplets "oy ", "y a", "nd ", "d g", and " gi" aren't included. Last, the computation of the hash value is simple and quick.

The signature of a string consists of 251 bits initialized to zero. If a triplet of the string hashes to a value i , the search program sets the i th bit (b_i) of the signature to 1 (equivalent to cutting a notch in the i th hole of a notched-edge card). Signatures of file records are called record signatures while those of search keys are called key signatures.

It's easy to find a single key in a large

text file. First, the search program loads the record signatures of the text file into memory (or as much as will fit at one time). Second, the program determines the signature of the key. Then it sequentially compares each record signature to the key signature.

If for every b_i equal to 1 in the key signature, a corresponding b_i is equal to 1 in the record signature, the screening test is positive, and the program brings the record into memory and searches for the key. If for any i , b_i equals 1 in the key signature and b_i doesn't equal 1 in the record signature, the key isn't present and you don't need to search the record.

This is the same as putting needles through holes in edge-notched cards. Cards that don't fall out when you lift the needles lack at least one of the attributes you're searching for and you can bypass them.

As a concrete example, take a text file with only three strings: "He ran down the lane", "Jill walks up the lane", and "The goat ran up the lane". See Table 2 for all triplets and the corresponding hash values for the three strings.

Suppose you want to search the file for all strings that contain the name "Jill". The key signature for the name "Jill" (Fig. 4) has bits 212 and 142 set to 1; all the other bits are zero.

Comparing the signature of the string "He ran down the lane" bit for bit with the key signature, you see that b_{212} of the key signature equals 1 while b_{212} of the record signature equals zero. The screening test is negative and you don't need to search the actual string.

Comparing the signature of the string "Jill walks up the lane" with that of the key signature, you see that every bit equal to 1 in the key signature is also equal to 1 in the record signature. Read the record from the disk, search it sequentially, and you find the name "Jill" present.

Comparing the signature of the string "The goat ran up the lane" with that of the key signature, you again find that every bit equal to 1 in the key signature also equals 1 in the record signature. You read the corresponding record from the file, search it sequentially, and determine that the key isn't present (a collision has occurred). If you had more records in the file, you could continue the search in the same manner.

Searching for a string that contains two or more keys is simple. The program logically ORs the key signatures

Assembly Language Shortcuts—Part II

by Bob Bowker

This month's shortcuts emphasize efficient use of the stack and include a reassuring perspective on the mysteries of algorithms.

CONDITION 1	CONDITION 2		CONDITION 20
LD BC,0123H	LD BC,0254H		LD BC,2017H
LD (BUF),BC	LD (BUF),BC	===== >>>	LD (BUF),BC
CALL ROUTINE	CALL ROUTINE		CALL ROUTINE
RET	RET		RET


```

ROUTINE LD HL,(BUF)
      .
      .
      .
      RET
  
```

Program Listing 1. Stack value pass.

CONDITION 1	CONDITION 2		CONDITION 20
POP HL	POP HL		POP HL
CALL ROUTINE	CALL ROUTINE	===== >>>	CALL ROUTINE
DEFB 32H	DEFB 54H		DEFB 17H
DEFB 01H	DEFB 02H		DEFB 20H


```

ROUTINE EX (SP),HL
      .
      .
      .
      RET
  
```

Program Listing 2. Byte-efficient Stack value pass.

In my last article on Assembly language programming (*80 Micro*, June 1983, p. 173), I discussed some techniques on reducing memory requirements. This month, I'll consider the stack, a last in/first out storage area used by the Z80 to save both addresses and values as it jumps around in a program. The stack is available to the user, too; you can store addresses and values on the stack with the Push command, and reclaim them with Pop.

When you call a subroutine, the computer automatically stores the return address on the stack, so that when it encounters a return instruction, the last address on the stack tells the program where to return to.

If your subroutine has left an extra address on the stack, when it encounters the return, the program returns to the extra address, not to the proper place. Similarly, if too many addresses are popped off the stack, the address to which the program returns will be wrong.

What's Wrong is Right

Sometimes you can misuse the stack to advantage. Suppose that you have a program with 20 possible situations,

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each of which must pass a unique value to a common Write routine. One possibility is Program Listing 1. There is a way to use the stack to pass the value, and, in this example, save many bytes. See Program Listing 2. In each of the 20 cases here, the POP HL instruction puts the main return address into the HL register pair, and the call routine puts the address of the first DEFB onto the stack, even though we have no intention of returning here. At routine, the 1-byte instruction EX (SP),HL puts the main return address on the stack, and the HL register pair points to byte 1 of the value to be passed. When the program encounters the return instruction at the end of routine, it goes back to the original code that called the condition and not to one of the DEFB lines.

How to Call Yourself

Shortcuts are often needed when the number of bytes available for the task is limited; if you have to fit a program in a 1K EPROM, that byte 1,025 has got to go.

I am also motivated by laziness: I don't like to type in the same code twice if I can help it. Duplicating several lines of code is a waste of both typing time and assembler space, so I came up with the subroutine in Program Listing 3 to convert a hex digit into 2 ASCII bytes to be displayed. This routine uses one return instruction to handle both passes through its code. Line 160 calls the subroutine; when the program encounters the return in line 240, it branches back to line 170 to the address on the stack and continues on until it hits line 240 again. This time, the return forces a branch back to the main calling code since that address is now on the stack.

There's no practical limit to the number of layers you can create using the one return instruction. This next example uses up to three passes through the same section of code, at various times, according to two switches. You could use it to allow for differences in how long you must wait for a disk drive motor to get up to speed. The first flag can indicate whether your speed-up modification is on, and the second flag can indicate that a full second is required for that drive to get to 300 revolutions per minute (rpm), as opposed to the half second required by newer drives. The original version is in Program Listing 4. The routine checks two flags and calls wait once for each flag that's on; then it calls a single wait regardless of the flags. Compare it to the version in Program Listing 5. The program uses a single subroutine and its re-

```

00100 57      CONV  LD D,A      ;Store for now
00100 E6F0    AND 0F0H      ;Dump bot 4 bits
00120 0F      RRCA         ;Do the rotate trick
00130 0F      RRCA
00140 0F      RRCA
00150 0F      RRCA
00160 CDxxxx  CALL SUB      ;Call the subroutine
00170 57      LDA,D         ;Recall the number
00180 E60F    AND 0FH       ;Dump top 4 bits
00190 C630    SUB          ;Make it ASCII
00200 FE3A    CP 3AH        ;Allow for HEX
                                digits
00210 3802    JR C,ONE      ;A thru F
00220 C607    ADD A,07H     ;
00230 CDxxxx  ONE  CALL 003BH ;Output the byte
00240 C9      RET

```

Program Listing 3. ASCII converter.

```

00100 01FFFF DELAY LD BC,0FFFFH ;Delay length
00110 3Axxxx  LD A,(FLAG) ;Get flag
00120 F5      PUSH AF      ;Save the flag
00130 CB47    BIT 0,A       ;Check bit 0
00140 C46000  CALL NZ,60H  ;Wait if it's on
00150 F1      POP AF       ;Restore orig (FLAG)
00160 F5      PUSH AF      ;...and store again
00170 01FFFF  LD BC,0FFFFH ;Delay length
00180 BB4F    BIT 1,A       ;Check bit 1
00190 C46000  CALL NZ,60H  ;Wait if it's on
00200 F1      POP AF       ;Restore orig (FLAG)
00210 01FFFF  LD BC,0FFFFH ;Delay length
00220 CD6000  CALL 60H     ;Standard wait
00230 C9      RET         ;Job's done

```

Program Listing 4. Three-pass routine.

```

00100 010000 DELAY LD BC,0000H ;Delay count
00110 3Axxxx  LD A,(FLAG) ;Get flags
00120 CB47    BIT 0,A       ;Check bit 0
00130 C4xxxx  CALL NZ,SUB1 ;Delay if on
00140 CB4F    BIT 1,A       ;Check bit 1
00150 C4xxxx  CALL NZ,SUB1 ;Delay if on
00160 F5      SUBI         ;Save flags
00170 CD6000  CALL 0060H   ;...and delay
00180 F1      POP AF       ;Restore flags
00190 C9      RET

```

Program Listing 5. Single subroutine option.

turn several times. Each time the return is encountered, the program branches to the last address on the stack. If bit 0 of (FLAG) is on, the return forces a return to line 140, and to line 160 if bit 1 is on. If neither is on, the return branches back to the code that called the delay.

The program initially sets BC register pair to 0000 hexadecimal (hex) instead of 0FFFF hex since the wait routine 0060 hex returns it to 0000 hex every time it's called; thus BC is set up for the

next pass. That one extra count in the delay is only 14.65 microseconds, which in most cases won't hurt. The bonus in using the second routine is that 8 bytes are saved—over 25 percent!

End of the Line

The word algorithm is not only ugly, it's scary. That concept has probably kept more people away from Assembly-language programming than T-Bug ever did. An algorithm is nothing more than a way to do something.

00100	3Axxxx	LINE	LD A,(4020H)	:Get CSRPOS LSB
00110	CB67		BIT 4,A	;Bit 4 on?
00120	C0		RET NZ	;Go back if yes
00130	CB6F		BIT 5,A	;Bit 5 on?
00140	C0		RET NZ	;Go back if yes
00160	CDxxxx		CALL NULINE	;It's a new line
00170	C9		RET	;Now go back

Program Listing 6. Algorithm check.

For example, once I needed a way to tell if the cursor was positioned at the start of a line on the screen. At one point I considered making a table of the 16 start-of-line addresses and doing 16 compares every time.

Then I found a blank page of Radio Shack's \$1.95 Video Display Worksheet paper left over from Level I days, and wrote the 16 addresses in a column down the left side. I converted the addresses to binary and wrote them down, too. In every case both bit 4 and bit 5 were off; that turned out to be an absolute test. If either bit 4 or bit 5 of the least significant byte (LSB) of the address of the cursor were on, the cursor was not at the start of a line on the screen. I had an algorithm (see Program Listing 6). This routine checks bits 4

*"Don't be frightened off
by jargon like algorithm;
if what you're looking for,
or what you've found,
is a shortcut,
call it that."*

and 5; if either is on, the cursor is not at the start of a line, so it returns. If both are off, the program calls the subroutine Nuline to do whatever, followed by the main return.

Don't be frightened off by jargon like algorithm; if what you're looking for,

or what you've found, is a shortcut, call it that.

To Vector or Not to Vector

Lowercase modifications on the Model I are pretty common now, but not all users have them. This poses a problem if you're going to sell, or otherwise distribute, a program to others; you have to make allowances for the unmodified computers. Also, if your program uses the printer in any way, you should allow for those who don't have one. There are few things more frustrating than to accidentally hit the P key, and sit helplessly as the computer locks up in a ROM loop looking for a printer that isn't there.

Vector is more jargon; it means jump, so let's call it a jump. That's also an easy way out of the problem: Place a jump or two at the start of your program, that can be changed by any user to allow for printers and lowercase.

For example, I wrote a program that calls a conversion subroutine just before printing every character on the screen; if the character were lowercase, it would be converted to uppercase. Before displaying the character in A on the screen, I would call LC2UC.

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My program also jumped through a subroutine on its way to the line printer; to print the character in A, I would call print.

```
00100 C3xxxx LC2UC JP CONV ;Go convert
      LC to UC
00110 C3xxxx PRINT JP LPR ;Go print out
```

These were the first two lines of the program, which loaded at 5200 hex. I included instructions to zap a return into line 100 (a C9 at 5200 hex) if the user had a lowercase mod; then, every time LC2UC was called, the program found a return before it could convert anything. Similarly, the program could zap a return into line 110 (a C9 at 5202 hex) if the user had no printer; this effectively disables the print command in the program.

Was That a I or a III?

When it first came out, the Model III was advertised as able to run all Model I software. As it turns out, that just isn't so; the culprits are the new ROMs in the III, which are different from the I's.

For most people, this is not important. However, if you want to sell a program that works on both, you have a decision to make: Should you sell separate versions, or try to write one version that works on both models?

rate versions, or try to write one version that works on both models? If you choose to do the latter, you've still got problems. You must either make sure the program uses only those routines which are common to both models, or you must somehow have your program modify itself based on the host model.

The last choice is not difficult. You can tell whether the computer running

*"Should you sell
separate versions,
or try to write
one version that works
on both models?"*

your program is a III or a I by looking at the byte at 0054 hex in the ROM; if it's a 01 hex, you're on a Model I, and if it's an EB hex you're on a III. There are probably other addresses you can use, although this is the only reliable one I know.

Start your program after the jumps with a check of 0054 hex, and deal with the result accordingly. For instance, if you find that your computer is a III, you may want to disable your own LC vector right away by putting a return there, and store a 00 hex at 4019 hex to default the III to lowercase. If any of the DOS calls you intend to use are different in Model III versions of the operating system, you can alter them now. For example, assume that a DOS call in Model I is at 4290 hex, and in the Model III is at 442B hex.

```
01320 CD9042 HERE CALL 4290H ;Model I
      CALL
```

If your check finds that you're on a III, include the following lines before starting the main program:

```
65000 212B44 LD HL,442BH ;Model III address
65010 22xxxx LD (HERE+1),HL
```

When line 1320 is encountered, the proper Model III address will be called. ■

Robert Bowker is a free-lance television director. He can be reached at 11360 Sunset Blvd., Los Angeles, CA 90049.

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by Terry Kepner

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CP/M, Control Program for Microprocessors, was the first comprehensive in-memory disk operating system for 8080 and Z80 based microcomputers. And now it's available to those who own Model IIIs.

The three Model III CP/M conversion boards included in this review are the Mapper III from Omikron, the VID-80 from Holmes Engineering, and

the Shuffleboard III from Memory Merchant.

All three boards offer useful modifications, but their features do differ. Shuffleboard is the only one that lets you perform single-drive file copies, while Mapper III alone lets you transfer files and programs from TRSDOS disks to CP/M disks.

The Holmes board stands apart in that it modifies your Model III's ROM to use an 80-character by 24-line display in standard TRSDOS environments as well as the CP/M environment.

While all three boards provide CP/M capability, you should consider their features and choose the board best suited for you.

Each modification is similar in concept: You remove the Z80 CPU and put it on the CP/M board, then plug the CP/M board into the Z80 socket. The computer now operates as either a standard Model III or a Z80 CP/M computer.

Mapper III

Omikron sells several modification boards for the Models I and III, including four versions of the CP/M board (a 48K and a 64K RAM version for each computer), 8-inch drive support for the Models I and III, and a 24-line by 80-character video display modification for the Model III.

I'll describe the Model III 64K CP/M board, without the 8-inch drive board or the 80 by 24 display modification. The Mapper III is quite small, measuring 4 inches by 6 inches (see Photo 1). Centered on the right side of the board are the socket for your computer's Z80 chip and the pins for plugging the board into your computer.

The six pages of typeset installation instructions are clear, with many pictures to clarify the procedure. The guide is a professionally prepared pamphlet, the best hardware installation guide I've ever seen.

The installation instructions are easy to follow. You unplug the computer, then locate and remove the case screws. Lift off the cover, locate and remove the Radio Frequency Interference (RFI) shield screws, then remove the RFI shield.

Remove the Z80 chip (be very careful—bent pins aren't a total disaster, but make the installation difficult), plug it into the CP/M board (observe correct orientation of the chip in the socket), and plug the board into the computer Z80 socket. Finally, reassemble the computer. The entire installation takes about half an hour of continuous work.

Now I must fault the documentation. After reading the installation guide, I looked for instructions on turning on the system and testing the board's performance, but there aren't any.

The owner's manual (15 photocopied pages of mixed typesetting and printing) details the CP/M system, describing video, keyboard, RS-232, and printer drivers, plus other important information about the Omikron version of CP/M. But it doesn't contain instructions on turning on the system in TRSDOS, CP/M, or Level II Basic.

I've since discovered that Omikron is still writing the user's manual. By the time you read this review, the guide will be finished and included with the other manuals.

When I turned my system on, strange characters filled the screen; I got no drive response and other peculiar reactions. I took my computer apart, removed the CP/M board, then replaced it and reassembled the computer. This time everything worked the way it should and the drive light came on.

The video screen displays the Omikron sign-on message, with two operation choices listed, C and T. Pressing the C key causes the Model III to boot up the CP/M disk in drive zero. Pressing T boots a TRSDOS disk. If you

want Level III Basic, press T and the break key. TRSDOS operation remains unchanged.

Omikron designed the video driver to emulate the Soroc IQ120 terminal, so any CP/M programs compatible with

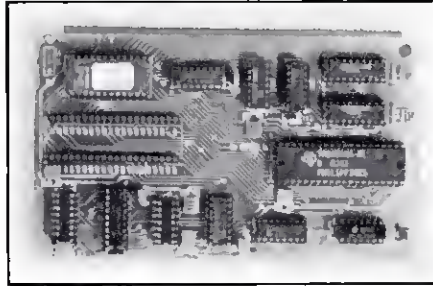


Photo 1. Mapper III.

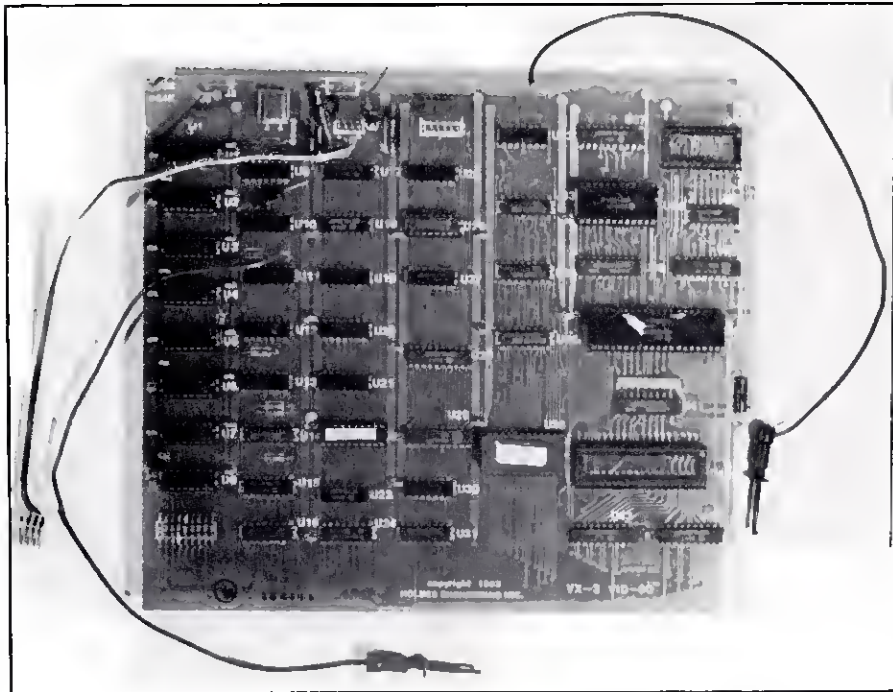


Photo 2. VID-80.

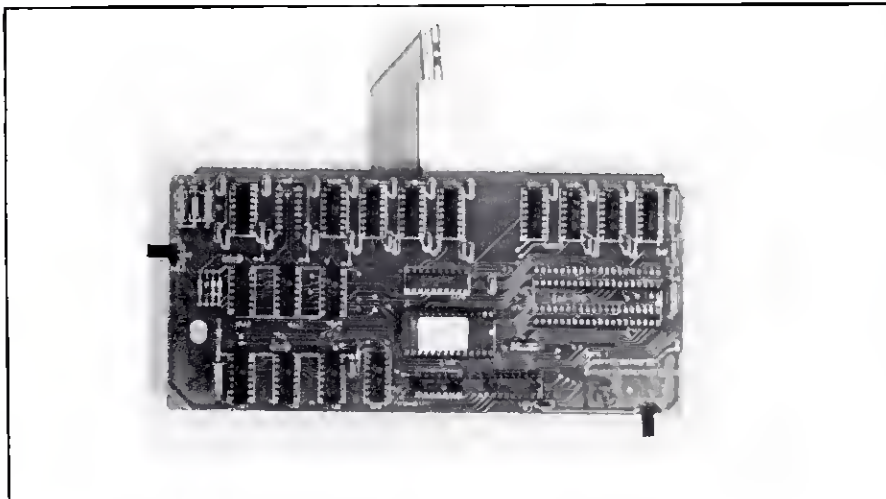
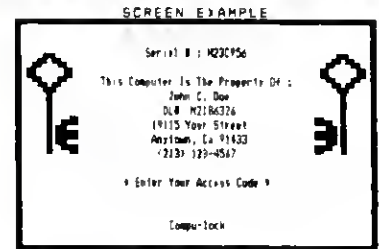


Photo 3. Shuffleboard III.

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The Compu-lock is available for the TRS-80 models 1, 3, & 4 and soon for other popular computers. Dealer inquiries invited.

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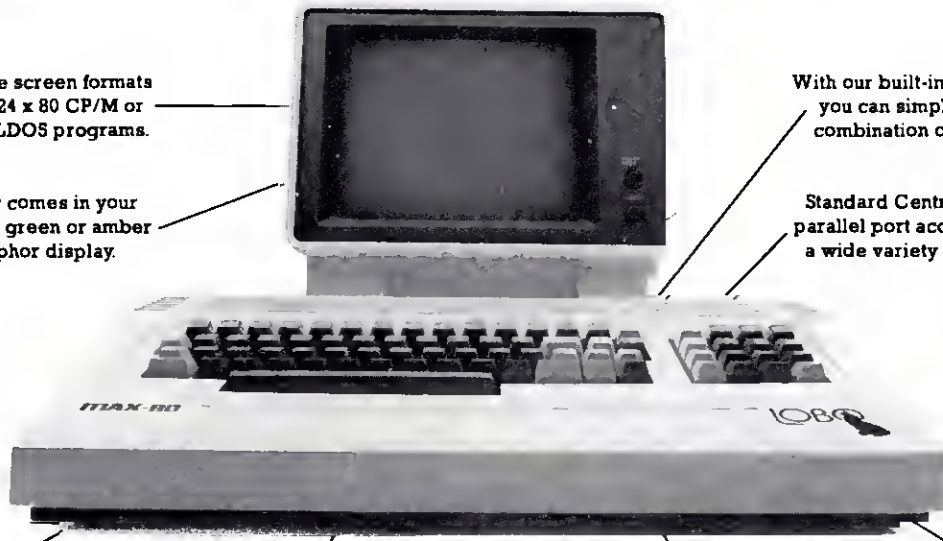
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the Soroc terminal should work without alteration. The cursor addressing routine is the same system used by the Osborne accounting packages, WordStar, and Wordmaster.

If you have 8-inch disk drive capability, Omikron's version of CP/M automatically supports it, assuming that drives A and B are 5¼-inch, and C and D are 8-inch. Since much software is sold on 8-inch disks, Omikron provides an option that lets you use control/C to warm-boot the system and make the 8-inch drives (physically located at positions C and D) the logical drives A and B.

If you have a special drive configuration, you can use the Options utility to preset the system to match your needs. The Options program controls other factors, including video graphics enable, blinking cursor, printer line counter and line feeds, RS-232 and keyboard swapping (lets you use a remote termi-

nal to control the system), and interrupt disable.

At the moment Omikron CP/M supports only 5¼-inch single- and double-density disk drives. As soon as they complete their 8-inch double-density board, it will support 8-inch single- and double-density disk drives. In the mean-

"... Omikron includes a Microsoft Basic disk with their CP/M system..."

time, Omikron CP/M reads 17 disk formats, including Osborne, IBM PC, Cromemco, Xerox, DEC, and Superbrain.

To aid the prospective programmer, Omikron includes a special utility program that lets you read Model III TRSDOS disks, and copy files and pro-

grams from TRSDOS to CP/M. These programs might or might not work under CP/M.

Machine-language programs that use their own input/output (I/O) routines won't work under CP/M, since the peripherals have all been remapped to new locations. Basic programs should work with MBasic, unless they have machine-language PEEKs and POKEs.

To help the Basic programmer, Omikron includes a Microsoft Basic (MBasic) disk with their CP/M system, so you can immediately begin using your system to create standard Basic programs (most Model III Basic commands are used in MBasic). This is important since CP/M doesn't include a Basic programming system, although some versions of CP/M include a public domain version of Basic called EBasic.

Finally, Omikron supplies a set of new CP/M and MBasic manuals that are truly superior to any I've seen on

The CP/M Story

The birth of CP/M resulted from a need for a microcomputer disk operating system back when micros were only the toys of computer hobbyists and professionals. A few pioneers in the industry had managed to build computer systems that included a CPU, had the capability of running a video display, and would let you input data and instructions from a keyboard.

Someone had even figured out how to connect disk drives to the machine and transfer data between the two. One programmer, at the request of a business friend, took one such system and wrote a program that supervised the operation of the computer, monitor, keyboard, printer, and disk drives. This original DOS design was for an 8080 Altair.

The program was so successful at controlling the computer without lots of work and attention from the user that other people began asking for copies. Finally, Digital Research Inc. began selling the DOS and it rapidly spread across the country.

It was so popular because it was designed to be device independent. The CP/M system used set addresses for sending and receiving information to and from the various peripherals. A new computer merely had to honor those addresses to be compati-

ble with CP/M and CP/M programs.

Of course, each model computer had different peripherals, some with wider displays or better keyboards, requiring different driver machine-code instructions, but CP/M doesn't care what the actual driver code looks like, only that the driver responds to the proper CP/M data address.

This means that a program written on a CP/M computer, as long as it honors the CP/M I/O calls, runs on almost any other CP/M computer. If your computer is from a new company, or even if you designed and built it yourself, you still have many CP/M programs available for it. Owners of non-CP/M computers have to wait for programmers to buy the computers and start writing programs for them.

As the oldest available DOS, CP/M has the most programs written for it. In many cases these programs are public domain, free for you to use and change. This public software is often of very high quality.

Other computer companies marketed their own DOSes for their computers, but CP/M had already become a standard. And people didn't want to buy a computer without software support.

When Tandy released the original Model I, they didn't design it to be a disk-based computer so they ignored

CP/M. When Level II came out, it too ignored the possibility of CP/M because CP/M requires the use of low memory for its driver addresses and high memory for its own code. The Radio Shack uses all low memory addresses for itself and high memory for programs.

To allow for both TRS-80 Basic and future CP/M expansion would have required that Tandy abandon their Level I customers or replace the entire CPU Level I board when they upgraded the machines to Level II. They would have to switch RAM and ROM, requiring a new circuit board layout. The mechanical problems of redesigning the computer and replacing the units in the field were too costly.

CP/M requires using the low addresses of RAM as its tie points to the peripherals. The Models I and III use the low addresses for other purposes, making them fundamentally incompatible.

For a while, a doctored version of CP/M was available for the Models I and III, but it experienced compatibility problems with much of the CP/M software. The software expected the peripheral connection addresses to be in low memory.

Now several companies have begun marketing boards that let Model I and III owners convert to CP/M operation while still maintaining compatibility with TRSDOS. ■

CP/M. The CP/M manual is 250 pages long in 8- by 11-inch format.

The MBasic manual was written in 5- by 7-inch format, but has been reproduced on 8- by 11-inch paper, with two 5- by 7-inch pages on one 8- by 11-inch piece of paper. It's a little confusing at first, but usable. Both manuals are typeset and punched for insertion in a three-ring binder.

VID-80

The Holmes CP/M system is a much larger board than the Mapper III, measuring 8 inches by 11 inches (see Photo 2). As with the Omikron board, you remove the Z80 CPU from the Model III and plug it into the Holmes board. However, you also remove the character generator ROM, the power supply connector, and the video connector from the old CPU board, and plug them into the Holmes board.

Then you attach two wires from the VID-80 to the Model III with small clamps, and plug the Holmes video controller into the slot on the old CPU board. These modifications make it possible for the Model III to run CP/M, and alter the video to use 80

characters by 24 lines as the standard display.

In fact, if you are only interested in an 80 by 24 display, you can buy the VID-80 board alone, and forget CP/M. CP/M is not required for the 80 by 24 display, and you can purchase it separately for \$120 extra.

This new display size has an important implication for CP/M operation: Some software on the market requires an 80 by 24 display. A display size other than that can cause problems when you try to use software designed for the larger display. Fortunately, much of the CP/M software doesn't have a display size requirement, so you can use a standard 64 by 16 screen display.

The documentation is a 34-page 8½- by 11-inch booklet that clearly explains every step for dismantling your computer, installing the Holmes board, and putting everything back together. It's not as slickly produced as the Omikron instructions, but is adequate to the task.

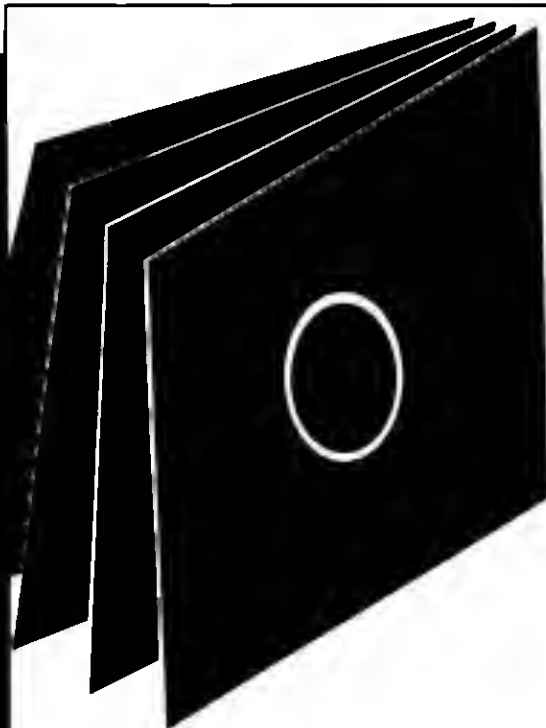
The instructions on CP/M are divided into two distinct sections. The first is part of the installation manual, and provides technical information

about the CP/M board and the Holmes CP/M Basic Input/Output System (BIOS) information. It also includes brief instructions on turning on and using your Holmes modified computer and an introduction to the CP/M operating system.

The second part of the CP/M instructions is in the form of the Sybex book about CP/M by Rodney Zaks, *The CP/M Handbook with MP/M*. Rather than plowing through the CP/M 2.2 Digital Research manuals, which tend to be confusing and hard to read, you can study a well-written tutorial on the CP/M system, with indexes and appendices to help guide you through it.

The theory of operation for the Holmes board is simple: When you turn on the computer or press reset, the Holmes board bootstrap ROM checks to see if you're holding down the 6 key. If you are, the bootstrap ROM relinquishes control to the Model III ROM and your computer acts as though it's unmodified.

If you're not holding down the 6 key, the bootstrap ROM copies the Model III ROM to a 16K bank of RAM on the Holmes board, then patches the Model



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III ROM in RAM to use the new 80 by 24 display. Every point where the ROM would normally jump to the Radio Shack video driver changes to use the Holmes video driver.

The locations normally assigned to the video RAM (3C00 to 3FFF hexadecimal (hex)) aren't used for video; the system ignores them. The new video RAM location is the uppermost 2K of RAM in your computer (F800 to FFFF hex).

Normally this means that you wouldn't have a full 64K of user RAM, but the Holmes board uses a bank-switching technique to flip the video RAM into place when the computer wants to access it, and to flip normal RAM in place the rest of the time. Thus your high memory Model III drivers are preserved for your use without alteration.

This method works because the Z80 can do only one thing at a time: When it's working on video RAM it can't use the high memory drivers or information, and vice versa. This is an interesting and efficient method of handling the video memory problem.

Unfortunately, by moving the video RAM to a new location, any programs

that bypass the video's device control blocks by going directly to video locations in the range 3C00 to 3FFF hex won't work in the 80 by 24 display mode, so you have to remember to set the display to 64 by 16 when using those programs.

When you first install the Holmes board, you have to adjust the video dis-

"The CP/M mode is quite transparent..."

play circuit board in the Model III to get all 24 lines on the screen. This takes only a few moments, and it's kind of fun watching the letters on the display scrunch down and new lines appear from the bottom.

The new 80 by 24 display requires that the individual characters be smaller, in order for all of them to fit on the screen. That's a small price to pay for almost doubling (from 1,024 to 1,920) the amount of information on your screen—an 80 percent increase.

Another disadvantage is the appearance of snow on the video whenever you update the display, much like the snow

on a normal Model III during high-speed display access (usually apparent during machine-language games). Fortunately, Holmes Engineering has a modification that makes the display clear and precise. Newer boards come with the modification.

This approach, moving ROM to RAM and modifying it to use the 80 by 24 display, lets you use almost any Model III DOS with the 80 by 24 display. For example, TRSDOS works quite well in the 80 by 24 mode, with only the DIR command requiring a patch [PATCH *6 (ADD=5AFA,FIND=3F,CHG=OF)] to operate correctly in both display modes. Similarly DOS-PLUS 3.4, 3.5, and 4.x, NEWDOS80, LDOS, and MULTIDOS work with little or no alterations in both modes. They require no special software drivers.

One other feature, reverse video, is accessible from either Model III mode or CP/M mode.

The CP/M mode is quite transparent to the operator. Memory management on the Model III in CP/M mode gives you 62K of RAM (the other 2K is for disk I/O buffers and other miscellaneous data involved with the disk drives).

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The Holmes board uses a 4K EPROM for keyboard, video, and printer I/O. This EPROM is bank switched in and out of position in low memory as needed by the BIOS.

The Holmes board lets you read and write to disks formatted by the IBM PC, Kaypro II, Xerox 820, Xerox 820-II, Osborne-I, Zenith Z-100, Freedom Technology (Model III CP/M system), Memory Merchant Shuffleboard III (Model III CP/M), Omikron (Model I CP/M), and Morrow Micro-Decision.

If your computer has 8-inch disk drive capability, Holmes CP/M lets you use the 8-inch drives without patching. Eight-inch drive support includes the ability to read and write to disks formatted in IBM 3740 single density, Xerox 820 single density, and Xerox 820-II double density.

The Holmes board is available in two versions. The first, and cheaper, version has a 16K bank of RAM and uses the Model III's 48K RAM for the rest of the RAM it needs. The other version comes with 64K of on-board RAM and doesn't use the Model III RAM except as a RAM disk accessible from CP/M

for extremely fast data storage and retrieval.

When I wrote this review, no known incompatibilities existed between Holmes CP/M and other CP/M software. You can even run UCSD Pascal with the Holmes board.

Shuffleboard III

The Shuffleboard III (see Photo 3), a 64K CP/M 2.2 system, is as easy as the others to install. The only difference is that you remove one of the Model III memory chips, U25, and replace it with a 16-pin plug attached to the Shuffleboard unit. After installing the board, you put your TRSDOS disk or your CP/M disk in drive zero and press reset. Level II Basic is still available, of course.

Like Omikron, Memory Merchant has provided MBasic for Basic programmers. You can also purchase an 80 by 24 video board separately for \$275.

Actually, you have several hardware options with the Shuffleboard: If you want to, you can move a jumper on the board from its "Automatic boot from drive zero" position to another. This clears the screen and asks you which

drive contains the system disk (press zero for drive zero, one for drive 1, and so on).

Another board option lets you select operation of either a 2716 ROM, or 2732 or 2764 ROMs. The manual doesn't discuss this option, so it's probably being reserved for future developments and enhancements.

A unique feature of Shuffleboard is the ability to switch between CP/M and TRSDOS using the appropriate command. If you're in TRSDOS and want to go to CP/M, enter the DOS command CPM. From the CP/M prompt, enter DOS. These are memory erasing changes: Anything in memory is zeroed out, so you can't transfer between the two operating systems and maintain in-memory data integrity.

In its present form, Shuffleboard CP/M is compatible with 35-, 40-, 77-, and 80-track 5 1/4-inch disk drives. With the addition of the Memory Merchant disk controller, you can use 8-inch disk drives.

As with the Omikron board, you can use your Model III as a slave to a remote terminal, using the remote terminal for input instead of the keyboard.

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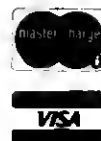
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And unlike the other two CP/M systems, Shuffleboard includes the Auto command as a valid command, which operates just like the TRSDOS Auto command. The length of the command is limited to one screen line (64 characters).

Memory Merchant CP/M is configured to expect the CP/M drive A to be the physical drive zero, drive B to be drive 1, drive C to be drive 2, drive D to be drive 3, and drive E to be nonexistent. Drive E invokes a special Memory Merchant CP/M utility called a virtual drive. You also have drives F-I available as single-density drives.

The first two logical drives (A and B) are 5¼-inch, 40-track, double-density drives. The third drive is configured as an 8-inch, 77-track, double-density drive. You can reorganize the CP/M drive map to match any setup you have, including using physical drive 4 as the boot-up drive, logical drive A. You do all this by using a disk drive map that lets you match any of the logical drive parameters to the physical drives.

Now for the virtual drive. Memory Merchant has altered CP/M so you can logically change a disk drive assignment while running CP/M, a procedure not allowed with the other CP/M systems. This virtual drive capability means that you can make single-drive copies.

If you have two 5¼-inch drives and one 8-inch drive, you can use the virtual drive assignment to copy a file from one 8-inch disk to another. Otherwise, you'd have to copy the file to a 5¼-inch disk, change disks in the 8-inch drive, invoke a warm-boot on that drive, then

copy the file from the 5¼-inch drive to the new 8-inch disk.

This virtual assignment capability is reflected in the use of logical drives F-I. Physical drives 1-3 are given two logical drive numbers, B-D and F-H. Drive 1 is both logical drive B and logical drive F. The difference is that drive B is a double-density drive and drive F is a single-density drive.

You can copy files from or to a single-density disk without going to the disk drive assignment table and changing one of the drives to be logically sin-

"All three boards are easy to install."

gle-density. To let you copy files between single density and double density on the same drive, logical drive I is used, just as logical drive E is used for single-drive, double-density file copying.

Speaking of copying, the Shuffleboard can read and write to Osborne I, Xerox 820, and IBM PC formatted disks.

Three manuals come with the Shuffleboard III. The user's manual is a 77-page, 8- by 11-inch printed booklet that covers all phases of board installation and CP/M use. The second manual is a bound edition of the new Digital Research documentation on CP/M.

The last manual is the Microsoft MBasic instruction book. Unlike the previous DRI manuals, these books are well written and easy to understand.

Both books top 250 pages in length.

Summary

All three boards are easy to install with only screwdrivers and a nail file. If you follow the instructions carefully, you should have no problems with the installation.

One disadvantage shared by all three boards is that they make it difficult for the CPU RFI shield to fit properly. The clearance between the RFI shield and the CPU board is almost, but not quite, enough room for the new piggy-back boards. On my Model III, I could only get the screws on the left side (looking at the CPU board from the rear of the computer) to go into place.

Putting the top and right side screws in place put a good deal of stress on the two boards, and actually forced the RFI shield to bulge. However, the three screws I used easily keep the shield in place, and should maintain the cage design of the Model III.

At present, the Holmes board has the largest base of CP/M disk formats that it can read and write, but the others are rapidly catching up. And all three companies offer excellent customer support, with customer hotline phone numbers.

As you can see, the final decision on which board is best depends on your needs. As a purely personal response, the Holmes Engineering board is my favorite; it seems to offer the most for my needs. ■

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Protected Tape Programs

by Dan Robinson

This pair of short routines safeguards your cassette programs against predators.

ProteK (with a K; see Program Listing 1) makes your system tape auto-start so spies can't jump into a monitor program. It adds a leader to your tape which befuddles copy programs like the RSM series or LMOFFSET by sending a false checksum. A double delay loop foils other copy cats that swallow programs until they think they've devoured the last byte.

The program includes pitfalls for

Protect your tape programs from predators with these two routines that prohibit copying.

those who load a monitor first and count on getting to your programs following a reboot: The entry points for TBUG, DEBUG, and RSM2 16K, 32K,

and 48K will take them back to the MEMORY SIZE? prompt.

ProteC (with a C; see Program Listing 2) converts your Basic program into a system tape with an auto-start feature and the same booby traps as its companion program. Furthermore, the program turns the trace off (TROFF) and disables the break key so that no one can list your program to the screen or a printer.

Instructions

To safeguard a Basic program, you can load ProteC either before or after your Basic file. As it completes its load, ProteC displays detailed instructions on the screen. The program then returns to the Basic READY prompt, and you're set to go.

ProteK does not list the instructions to the screen; you load it in series after the system program you wish to encode. When you load ProteK, it automatically boots up, asking for the name of the new system tape and the hexadecimal start/end/transfer address. The program prompts you to prepare the tape recorder, and then writes your encoded program.

Both ProteC and ProteK change some pointers and addresses, so once you've encoded your program it's wise to reset your TRS-80. ■

Contact Dan Robinson at 1625 Higgins Way, Pacifica, CA 94044.

Program Listing 1. ProteK routine.

```

41E2      00100 ;PROTEK 2.0---CASSETTE---SYSTEM TAPES ONLY
41E2 E9    00110 ORG 41E2H ;SYSTEM RELAY FOR AUTO START
7E00      00120 DEFB 0E9H
7E00      00130 ORG 7E00H ;PROTEK
7E00      00140 START EQU $
7E00 CDC901 00150 CALL 41C9H ;CLEAR SCREEN
7E03 21797F 00160 LD HL,MSG1 ;DISPLAY PGN NAME PROMPT
7E06 CDA720 00170 CALL 2BA7H
7E09 3E00    00180 LD A,80H
7E0B CD3A93 00190 CALL 033AH
7E0E 2AA740 00200 LD HL,(4BA7H)
7E11 4615    00210 LD B,21
7E13 CDD905 00220 CALL 05D9H ;INPUT NAME & ADDRESSES
7E16 116D7F 00230 LD DE,NAME
7E19 7E     00240 LD A,(HL)
7E1A FE2F   00250 CP 2FH ;"/"
7E1C 2805   00260 JR Z,NAME2
7E1E 12     00270 LD (DE),A
7E1F 23     00280 INC HL
7E20 13     00290 INC DE
7E21 18F6   00300 JR NAME1
7E23 CD1D7F 00310 NAME2 CALL HEX
7E26 32747F 00320 LD (STADR+1),A
7E29 CD1D7F 00330 CALL HEX
7E2C 32737F 00340 LD (STADR),A
7E2F 23     00350 INC HL
7E30 CD1D7F 00360 CALL HEX
7E33 32767F 00370 LD (ENDADR+1),A
7E36 CD1D7F 00380 CALL HEX
7E39 32757F 00390 LD (ENDADR),A
7E3C 23     00400 INC HL
7E3D CD1D7F 00410 CALL HEX
7E40 32787F 00420 LD (TRFADR+1),A
7E43 CD1D7F 00430 CALL HEX
7E46 32777F 00440 LD (TRFADR),A
7E49 3E00    00450 LD A,80H
7E4B CD3A93 00460 CALL 033AH
7E4E 21AA7F 00470 LD HL,MSG2 ;DISPLAY PREPARE RECORDER
7E51 CDA720 00480 CALL 2BA7H
7E54 010000 00490 LD BC,0000
7E57 CD6000 00500 CALL 0060H
7E5A B7     00510 OR A
7E5B 3A4030 00520 READY LD A,(3040H) ;CHECK KEYBOARD FOR <ENTER>
7E5E FE01    00530 CP 01H
7E60 2807   00540 JR Z,REC
7E62 FE04    00550 CP 04 ;CHECK KEYBOARD FOR <BREAK>
7E64 CA807E 00560 JP Z,START ;RETURN TO BASIC

```

Listing 1 continued

The Key Box

Model I
16K RAM
Assembly Language
Editor/Assembler
Tape Recorder

Listing 1 continued

```

7E67 18F2 00570 JR READY
7E69 F3 00580 DI
7E6A 3E2A 00590 LD A,2AH
7E6C 323E3C 00600 LD (3C3EH),A ;STAR
7E6F 3E00 00610 LD A,0
7E71 CD1202 00620 CALL 0212H ;INITIALIZE RECORDER 01
7E74 CD8702 00630 CALL 0287H ;WRITE LEADER & SYNC BYTE
7E77 3E55 00640 LD A,55B ;SYSTEM TAPE ID
7E79 CD6402 00650 CALL 0264H ;WRITE BYTE
7E7C 116D7F 00660 LD DB,NAME
7E7F 0606 00670 LD B,6
7E81 1A 00680 WRTNAM LD A,(DE)
7E82 CD6402 00690 CALL 0264H
7E85 13 00700 INC DE
7E86 18F9 00710 DJNZ WRTNAM ;WRITE NAME
7E88 3E3C 00720 LD A,3CB ;DISABLE LNOFFSET
7E8A CD6402 00730 CALL 0264H
7E8D 3E01 00740 LD A,1
7E8F CD6402 00750 CALL 0264H
7E92 3E00 00760 LD A,00H
7E94 CD6402 00770 CALL 0264H
7E97 3E00 00780 LD A,00H
7E99 CD6402 00790 CALL 0264H
7E9C 3E00 00800 LD A,0
7E9E CD6402 00810 CALL 0264H
7EA1 CD6402 00820 CALL 0264H ;OUTPUT FALSE CHECKSUM
7EA4 213E3C 00830 LD HL,3C3EH
7EA7 DD21E07F 00840 LD IX,STAR
7EAB CD417F 00850 CALL SET
7EAE 010000 00860 LD BC,0000 ;DEFEAT TIMERS
7EB1 CD6000 00870 CALL 0060H
7EB4 CD6000 00880 CALL 0060H
7EB7 21A043 00890 LD HL,43ABH ;TBUG
7EBA CD3D7F 00900 CALL BLOCK
7EBD 21807F 00910 LD HL,7F80H ;RSN2 & 2D 16K
7EC0 CD3D7F 00920 CALL BLOCK
7EC3 2180BF 00930 LD HL,0BF00H ;RSN2D 32K
7EC6 CD3D7F 00940 CALL BLOCK
7EC9 2180FF 00950 LD HL,0FF00H ;RSN2D 48K
7ECB CD3D7F 00960 CALL BLOCK
7ECP 218F40 00970 LD BL,400FH ;DEBUG
7ED2 CD3D7F 00980 CALL BLOCK
00990 ;ADD BLOCKING ROUTINES HERE--LD HL,ADDR CALL BLOCK
7ED5 2A757F 01000 LD HL,(ENDADR)
7ED8 ED5B737F 01010 LD DE,(STADR)
7EDC 87 01020 OR A
7EDD ED52 01030 SBC HL,DE
7EDF EB 01040 EX DE,HL
7EE0 E5 01050 PUSH HL
7EE1 DDE1 01060 POP IX
7EE3 7A 01070 LD A,D
7EE4 FE00 01080 CP 0
7EE6 2800 01090 JR Z,WRT2
7EE8 0600 01100 NRT1 LD B,0
7EEA CD437F 01110 CALL PUNCH
7EED 15 01120 DEC D
7EEE 20F0 01130 JR NZ,NRT1
7EF0 78 01140 NRT2 LD A,E
7EF1 FE00 01150 CP 0
7EF3 CAPA7E 01160 JP Z,WRT3
7EF6 43 01170 LD B,E
7EF7 CD437F 01180 CALL PUNCH
7EFA 0601 01190 WRT3 LD B,1
7EFC DD216C7F 01200 LD IX,LIST
7F00 21E241 01210 LD HL,41E2H ;SYSTEM/AUTO-START RELAY
7F03 CD437F 01220 CALL PUNCH
7F06 ED5B777F 01230 LD DE,(TRFADR)
7F0A 3E78 01240 LD A,78H ;TRANSFER BLOCK
7F0C CD6402 01250 CALL 0264H
7F0F 7B 01260 LD A,E
7F10 CD6402 01270 CALL 0264H
7F13 7A 01280 LD A,D
7F14 CD6402 01290 CALL 0264H
7F17 CDF001 01300 CALL 01F0H ;TURN OFF RECORDER
7F1A C3007E 01310 JP START
7F1D 23 01320 HEX INC HL ;ASCII TO HEX
7F1E 7E 01330 LD A,(HL)
7F1F D630 01340 SUB 30H
7F21 FE0A 01350 CP 10
7F23 F43A7F 01360 CALL P,ADJ
7F26 CB27 01370 SLA A
7F28 CB27 01380 SLA A
7F2A CB27 01390 SLA A
7F2C CB27 01400 SLA A
7F2E 47 01410 LD B,A
7F2F 23 01420 INC HL
7F30 7E 01430 LD A,(HL)
7F31 D630 01440 SUB 30H
7F33 FE0A 01450 CP 10
7F35 F43A7F 01460 CALL P,ADJ
7F38 80 01470 ADD A,B
7F39 C9 01480 RET
7F3A D607 01490 ADJ SUB 7
7F3C C9 01500 RET
7F3D DD216B7F 01510 BLOCK LD B,1
7F41 0601 01520 SET LD A,3CH ;BLOCK SYNC
7F43 3E3C 01530 PUNCH LD 0264H ;WRITE BYTE
7F45 CD6402 01540 CALL 0264H ;BYTE COUNT
7F48 78 01550 LD A,B
7F49 CD6402 01560 CALL 0264H
7F4C 7D 01570 LD A,L ;LSB ADDRESS
7F4D CD6402 01580 CALL 0264H
7F50 4F 01590 LD C,A ;SAVE FOR CHECKSUM
7F51 7C 01600 LD A,H ;MSB ADDRESS
7F52 CD6402 01610 CALL 0264H
7F55 81 01620 ADD A,C
7F56 4F 01630 LD C,A

```

Listing 1 continued

SYSTEM DIAGNOSTIC

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Listing 1 continued

```

7F57 DD7E00 01640 PUN1 LD A,(IX)
7F5A CD6402 01650 CALL 0264H
7F5D 23 01660 INC HL
7F5E DD23 01670 INC IX
7F60 01 01680 ADD A,C
7F61 4F 01690 LD C,A
7F62 10F3 01700 DJNZ PUN1
7F64 CD6402 01710 CALL 0264H ;OUTPUT CHECKSUM
7F67 CD2C02 01720 CALL 022CH ;BLINK STAR
7F6A C9 01730 RET
7F69 76 01740 RESET DEFB 76H ;HALT CODE
7F6C E9 01750 LIST DEFB 0E9H
7F6D 20 01760 NAME DEFB 20H
7F6E 20 01770 DEFB 20H
7F6F 20 01780 DEFB 20H
7F70 20 01790 DEFB 20H
7F71 20 01800 DEFB 20H
7F72 20 01810 DEFB 20H
0002 01020 STADR DEFS 2 ;STORE START ADDRESS
0002 01030 ENDADR DEFS 2 ;STORE END ADDRESS
0002 01040 TRPADR DEFS 2 ;STORE ENTRY ADDRESS
7F79 45 01850 MSG1 DEFM 'ENTER PROGRAM NAME/START/END/ENTRY HEX ADDR
ESSES'
4E 54 45 52 20 50 52 4F
47 52 41 4D 20 4E 41 4D
45 2F 53 54 41 52 54 2F
45 4E 44 2F 45 4E 54 52
59 20 40 45 50 20 41 44
44 52 45 53 53 45 53
7FAA 00 01860 DEFB 0
7FAA 20 01870 MSG2 DEFM ' PREPARE RECORDER AND PRESS RECORD & PL
AY <ENTER>'
20 20 20 20 50 52 45 50
41 52 45 20 52 45 43 4F
52 44 45 52 20 41 4E 44
20 50 52 45 53 53 20 52
45 43 4F 52 44 20 26 20
50 4C 41 59 20 3C 45 4E
54 45 52 3E
7FDF 00 01880 DEFB 0
7FE0 2A 01890 STAR DEFB 2AH
7E00 01900 END START
00000 TOTAL ERRORS
    
```

Program Listing 2. ProteC routine.

```

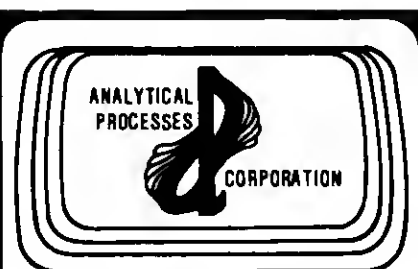
00100 ;PROTEC 1.1---BASIC CASSETTE TAPES ONLY
41E2 00110 ORG 41E2H ;SYSTEM RELAY FOR AUTO START
41E2 E9 00120 DEFB 0E9H
4001 00130 ORG 4001H ;BASIC TOP OF MEMORY PTR
4001 1F7E 00140 DEFW START-1
410E 00150 ORG 410EH ;NAME VECTOR
410E C3 00160 DEFB 0C3H ;JUMP
410F 207E 00170 DEFW START
4049 00180 ORG 4049H ;MEMORY SIZE
4049 1F7E 00190 DEFW START-1
7E20 00200 ORG 7E20H ;PROTEC
7E20 00210 START EQU $
7E20 CDC901 00220 CALL 01C9H ;CLEAR SCREEN
7E23 31207E 00230 LD SP,START+0
7E26 21837F 00240 LD HL,MSG1 ;DISPLAY PCN NAME PROMPT
7E29 CDA728 00250 CALL 20A7H
7E2C 3E0D 00260 LD A,0DH
7E2E CD3A03 00270 CALL 033AH
7E31 2AA740 00280 LD HL,(40A7H)
7E34 0606 00290 LD B,6
7E36 CDD905 00300 CALL 05D9H ;INPUT NAME
7E39 117D7F 00310 LD DE,NAME
7E3C 7E 00320 NAME1 LD A,(HL)
7E3D 12 00330 LD (DE),A
7E3E 23 00340 INC HL
7E3F 13 00350 INC DE
7E40 10FA 00360 DJNZ NAME1
7E42 3E0D 00370 LD A,0DH
7E44 CD3A03 00380 CALL 033AH
7E47 21967F 00390 LD HL,MSG2 ;DISPLAY PREPARE RECORDER
7E4A CDA728 00400 CALL 20A7H
7E4D 010000 00410 LD BC,0000
7E50 CD6000 00420 CALL 0060H
7E53 B7 00430 OR A
7E54 3A4030 00440 READY LD A,(3840H) ;CHECK KEYBOARD FOR <ENTER>
7E57 FE01 00450 CP 01H
7E59 2007 00460 JR Z,REC
7E5B FE04 00470 CP 04H ;CHECK KEYBOARD FOR <BREAK>
7E5D CA191A 00480 JP Z,1A19H ;RETURN TO BASIC
7E60 10F2 00490 JR READY
7E62 F3 00500 REC DI
7E63 3E2A 00510 LD A,2AH
7E65 323E3C 00520 LD (3C3EH),A ;STAR
7E68 3E00 00530 LD A,0
7E6A CD1202 00540 CALL 0212H ;INITIALIZE RECORDER #1
7E6D CD0702 00550 CALL 0207H ;WRITE LEADER & SYNC BYTE
7E70 3E55 00560 LD A,55H ;SYSTEM TAPE ID
7E72 CD6402 00570 CALL 0264H ;WRITE BYTE
7E75 117D7F 00580 LD DE,NAME
7E78 0606 00590 LD B,6
7E7A 1A 00600 WRTNAM LD A,(DE)
7E7B CD6402 00610 CALL 0264H
7E7E 13 00620 INC DE
7E7F 10F9 00630 DJNZ WRTNAM ;WRITE NAME
7E81 3E3C 00640 LD A,3CH ;DISABLE TRACE
    
```

Listing 2 continued

Listing 2 continued

7E03 CD6402	00010	CALL	0264H
7E06 3E01	00020	LD	A,1
7E08 CD6402	00030	CALL	0264H
7E0B 3E1B	00040	LD	A,10H
7E0D CD6402	00050	CALL	0264H
7E0F 3E41	00060	LD	A,41H
7E12 CD6402	00070	CALL	0264H
7E15 3E00	00080	LD	A,0
7E17 CD6402	00090	CALL	0264H
7E1A CD6402	00090	CALL	0264H ;OUTPUT FALSE CHECKSUM
7E1D 213E3C	00910	LD	HL,3C3EH
7E1F DD21CC7F	00930	LD	IX,STAR
7E24 CD477F	00940	CALL	SET
7E27 010000	00942	LD	BC,0000 ;DEFEAT TIMERS
7E2A CD6000	00944	CALL	0060H
7E2D CD6000	00946	CALL	0060H
7E2F 210000	00950	LD	HL,0000 ;LMOFFSET
7E33 CD437F	00970	CALL	BLOCK
7E36 21A043	00980	LD	HL,43A0H ;TBUG
7E39 CD437F	00990	CALL	BLOCK
7E3C 21007F	01000	LD	HL,7F00H ;RSM2 & 2D, 16K
7E3F CD437F	01010	CALL	BLOCK
7E42 2100BF	01020	LD	HL,0BF00H ;RSH2D 32K
7E45 CD437F	01030	CALL	BLOCK
7E48 2100FF	01040	LD	HL,0FF00H ;RSM2D 48K
7E4B CD437F	01050	CALL	BLOCK
7E4E 210F40	01052	LD	HL,400FH ;DEBUG
7E51 CD437F	01054	CALL	BLOCK
7E54 210C40	01056	LD	HL,400CH ;DISABLE BREAK KEY
7E57 DD217A7F	01058	LD	IX,BREAK
7E5B 0603	01060	LD	B,3
7E5D CD497F	01062	CALL	PUNCH
7E60 2AF940	01064	LD	HL,(40F9H) ;SIMPLE VARIABLES PTR
7E63 ED5BA440	01066	LD	DE,(40A4H) ;START OF BASIC PGH PTR
7E67 B7	01068	OR	A
7E6B ED52	01070	SBC	HL,DE
7E6E 2B	01072	DEC	HL
7E71 EB	01074	EX	DE,HL
7E74 E5	01076	PUSH	HL
7E77 DDE1	01078	POP	IX
7E7A 7A	01080	LD	A,D
7E7D FE00	01082	CP	0
7E7F 2800	01084	JR	Z,WRT2
7E82 0600	01100	LD	B,0
7E85 CD497F	01110	CALL	PUNCH
7E88 15	01120	DEC	D
7E8B 20F0	01130	JR	NZ,WRT1
7E8E 70	01140	LD	A,E
7E91 FE00	01150	CP	0
7E94 CA067F	01160	JP	Z,WRT3
7E97 43	01170	LD	B,E
7E9A CD497F	01180	CALL	PUNCH
7E9D E5	01190	PUSH	HL ;SAVE FOR TRANSFER
7EA0 DD21727F	01200	LD	IX,LIST
7EA3 0607	01210	LD	B,7
7EA6 CD497F	01220	CALL	PUNCH
7EA9 21E241	01240	LD	HL,41E2H ;SYSTEM/AUTO-START RELAY
7EAC CD477F	01250	CALL	SET
7EAF 0602	01290	LD	B,2
7EB2 21F940	01300	LD	HL,40F9H ;SIMPLE VARIABLES PTR
7EB5 E5	01310	PUSH	HL
7EB8 DDE1	01312	POP	IX
7EBB CD497F	01320	CALL	PUNCH
7EBF 21A440	01330	LD	HL,40A4H ;START OF BASIC PTR
7EC2 E5	01340	PUSH	HL
7EC5 DDE1	01342	POP	IX
7EC8 0602	01350	LD	B,2
7ECB CD497F	01360	CALL	PUNCH
7ED0 D1	01370	POP	DE ;RECOVER RUN BLOC
7ED3 3E70	01380	LD	A,70H ;TRANSFER BLOCK
7ED6 CD6402	01390	CALL	0264H
7ED9 7B	01400	LD	A,E ;RUN ROUTINE
7EDC CD6402	01410	CALL	0264H
7EDF 7A	01420	LD	A,D
7EE2 CD6402	01430	CALL	0264H
7EE5 CDF001	01440	CALL	01F0H ;TURN OFF RECORDER
7EE8 CDC901	01400	CALL	01C9H ;CLEAR SCREEN
7EEB C3191A	01490	JP	1A19H ;RETURN TO BASIC
7EEF DD21717F	01500	LD	IX,RESET
7EF2 0601	01510	LD	B,1
7EF5 3E3C	01520	LD	A,3CH ;BLOCK SYNC
7EF8 CD6402	01530	CALL	0264H ;WRITE BYTE
7EFB 78	01540	LD	A,B ;BYTE COUNT
7FE0 CD6402	01550	CALL	0264H
7FE3 7D	01560	LD	A,L ;LSB ADDRESS
7FE6 CD6402	01570	CALL	0264H
7FE9 4F	01580	LD	C,A
7FEC 7C	01590	LD	A,H ;SAVE FOR CHECKSUM
7FEF CD6402	01600	CALL	0264H ;MSB ADDRESS
7FF2 01	01610	ADD	A,C
7FF5 4F	01620	LD	C,A
7FF8 DD7E00	01630	LD	A,(IX)
7FFB CD6402	01640	CALL	0264H
7FF6 23	01650	INC	HL
7FF9 DD23	01660	INC	IX
7FFC 01	01670	ADD	A,C
7FF7 4F	01680	LD	C,A
7FFA 10F3	01690	DJNZ	FOH1
7FFD CD6402	01700	CALL	0264H ;OUTPUT CHECKSUM
7FF0 CD2C02	01710	CALL	022CH ;BLINK STAR
7FF3 C9	01720	RET	
7FF6 76	01722	DEFB	76H ;HALT CODE
7FF9 21	01730	DEFB	21H
7FFC 1E	01740	DEFB	1EH
7FF7 1D	01750	DEFB	1DH
7FFA E5	01760	DEFB	0E5H
7FFD C3	01770	DEFB	0C3H

Listing 2 continued



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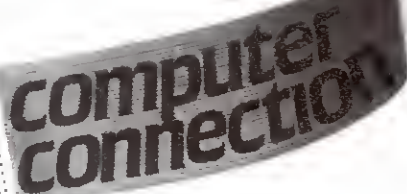
Listing 2 continued

```

7F77 5D      01780      DEFB  5DH
7F78 18      01790      DEFB  1BB
7F79 E9      01800      DEFB  0E9B
7F7A C3      01810 BREAK  DEFB  0C3B
7F7B 98      01820      DEFB  98B
7F7C 0A      01830      DEFB  0AR
7F7D 20      01840 NAME  DEFB  20H
7F7E 20      01842      DEFB  20H
7F7F 20      01844      DEFB  20H
7F80 20      01846      DEFB  20H
7F81 20      01848      DEFB  20H
7F82 20      01849      DEFB  20H
7F83 45      01850 MSG1   DEFN  'ENTER PROGRAM NAME'
4E 54 45 52 20 59 52 4F
47 52 41 4D 28 4E 41 4D
45
7F95 88      01860      DEFB  0
7F96 20      01870 MSG2   DEFN  '
AY <ENTER>'
20 28 20 28 50 52 45 58
41 52 45 20 52 45 43 4F
52 44 45 52 20 41 4E 44
20 50 52 45 53 53 20 52
45 43 4F 52 44 20 26 29
50 4C 41 59 28 3C 45 4E
54 45 52 3E
7FCB 00      01880      DEFB  0
7PCC 2A      01890 STAR   DEFB  2AH
3C00 00      01910      ORG   3C00H ;WRITE INSTRUCTIONS
3C00 20      01920      DEFN  '
PROTEC
20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20
20 20 20 20 50 52 4F 54
45 43 20 20 20 20 20 20
20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20
3C3F 20      01930      DEFN  '
C PROGRAM, TYPE NAME'
20 20 20 20 57 48 45 4E
20 59 4F 55 20 41 52 45
20 52 45 41 44 59 20 54
4F 20 45 4E 43 4F 44 45
20 59 4F 55 52 20 42 41
53 49 43 20 58 52 4F 47
52 41 4D 2C 20 54 59 59
45 20 4E 41 4D 45
3C7E 20      01940      DEFN  '
P TO SIX CHARACTERS '
20 3C 45 4E 54 45 52 3E
2E 20 20 59 4F 55 20 57
49 4C 4C 20 42 45 20 58
52 4F 4D 50 54 45 44 20
54 4F 20 45 4E 54 45 52
20 55 59 20 54 4F 20 53
49 58 20 43 48 41 52 41
43 54 45 52 53 20
3C8D 20      01950      DEFN  '
ERATE AS A SYSTEM TA'
20 20 55 4E 44 45 52 28
57 48 49 43 48 20 59 4F
55 52 20 45 4E 43 4F 44
45 44 20 58 52 4F 47 52
41 4D 20 57 49 4C 4C 20
4F 50 45 52 41 54 45 20
41 53 20 41 20 53 59 53
54 45 4D 20 54 41
3CFC 50      01960      DEFN  '
PREPARE THE RECORDER'
45 20 20 3C 45 4E 54 45
52 3E 2E 20 20 59 4F 55
20 57 49 4C 4C 20 54 48
45 4E 20 42 45 20 50 52
4F 4D 59 54 45 44 20 54
4F 20 50 52 45 50 41 52
45 20 54 48 45 20 52 45
43 4F 52 44 45 52
3D3B 2C      01970      DEFN  '
BASIC PROGRAM WILL'
20 20 20 20 58 52 45 53
53 49 4E 47 20 52 45 43
4F 52 44 20 41 4E 44 20
50 4C 41 59 20 3C 45 4E
54 45 52 3E 2E 20 59 4F
55 52 20 42 41 53 49 43
20 58 52 4F 47 52 41 4D
20 57 49 4C 4C
3D79 20      01980      DEFN  '
R TAPE, TYPE SYSTEM'
42 45 20 20 20 20 45 4E
43 4F 44 45 44 20 41 53
20 41 20 53 59 53 54 45
4D 20 54 41 50 45 2E 20
54 4F 20 52 55 4E 20 59
4F 55 52 20 54 41 50 45
2C 20 54 59 50 45 20 53
59 53 54 45 4D
3DB7 20      01990      DEFN  '
E UNDER WHICH THE'
3C 45 4E 54 45 52 3E 2E
20 20 20 20 41 54 20 54
48 45 20 50 52 4F 4D 50
54 20 2A 3F 29 45 4E 54
45 52 20 54 48 45 20 4E

```

Listing 2 continued



computer
connection

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Channels of Communication

by Dan Keen and Dave Dischert

Home satellite receiving dishes can bring you more than 140 cable stations free. This article explains dish technology and positioning.

You're sitting at home on a Friday night, looking for something entertaining to watch on television. But all that's on are reruns of *The Dukes of Hazzard*, a show on how to train your dog, and the Miss Teen U.S.A. pageant.

You do have an alternative—more than 140 TV and movie stations, each of which comes into your home free. All you need is a satellite receiver and a

Model I or III.

In this article we discuss how satellite receivers work, how to get one, the costs and time involved, and how to use your Model I or III to position your receiving dish to pull in signals from different satellites.

Satellite Receiver Boom

Home satellite receivers are gaining in

popularity. Currently, more than 100,000 U.S. homes have receivers. As more dishes are set up and newer, less expensive technology becomes available, dish receivers will drop in price and come within reach of almost everyone. As it is, satellite receiver systems are significantly less expensive today than they were five years ago. You can get a complete system now for as little as \$2,500.

The Technology

Cable program signals travel around the United States via satellite (see Fig. 1). The transmitting station that generates the microwave signal beams it up to an orbiting satellite.

The satellite receives the signal, cleans it up, and rebroadcasts it to receiving stations scattered across the United States. These receiving stations then send the signal, via ground-based cables, to homes.

Home receiving dishes work just like their commercial counterparts. They, too, pick up signals from satellites, but instead of sending them out over commercial cables, they shunt the signal to your home television set.

Communications satellites orbit directly over the equator in a geostationary orbit at an altitude of 22,300 miles. Satellites occur in the North American continent in an equatorial arc of from roughly 83 to 135 degrees longitude, with a spread of about four degrees.

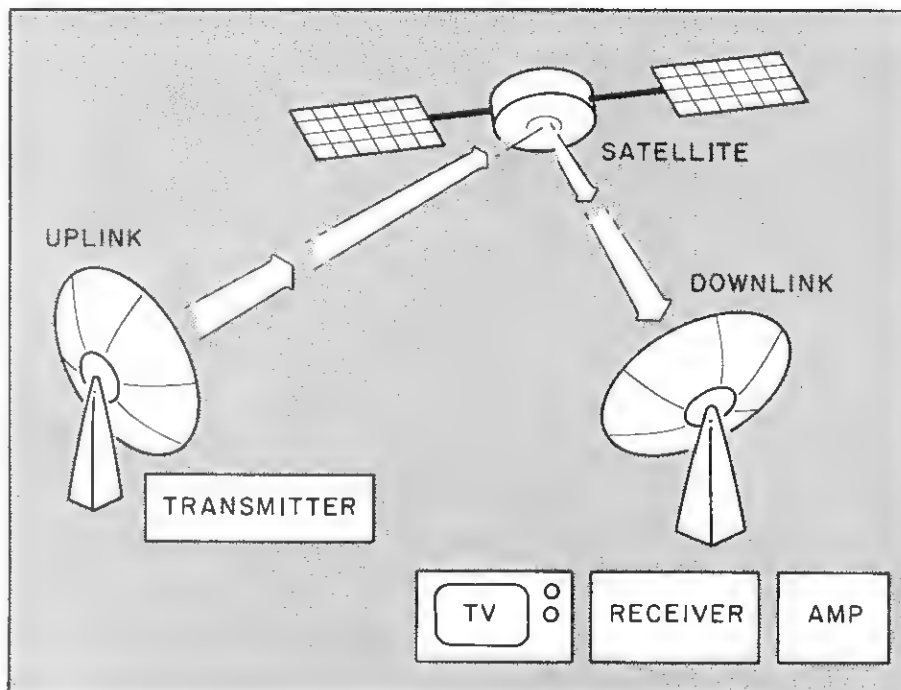


Figure 1. The basic components of a satellite TV system.

The Key Box

Model I and III
16K RAM Cassette Basic
32K RAM Disk Basic

Television Stations

Typically, satellites have either 12 or 24 channels, called transponders. Several communications satellites carry a full load (24 channels) devoted to television programming.

Some programs are free religious or commercial stations, such as Satellite News Channel and Music Television. Other channels may be illegal to receive, such as Home Box Office and Showtime, but comprehensive laws governing this medium are still being debated.

Satcom F3R, the most widely accessed satellite, is one of the few that dedicates all 24 transponders to television programming. It carries Nickelodeon, The Movie Channel, ESPN (entertainment sports), MTV (Music Television), Cable News Network, the Christian Broadcast Network, and superstations WGN and WTBS. The Program Listing contains all the stations available through Satcom F3R.

U.S. companies launch more satellites each year, providing a larger selection of programming services from which to choose.

Getting the Signal

Communications satellites send out polarized microwave beams in either a horizontal or vertical format. For example, RCA's Satcom F3R satellite has horizontal polarization on even transponders and vertical polarization on odd transponders. The Westar 3 satel-

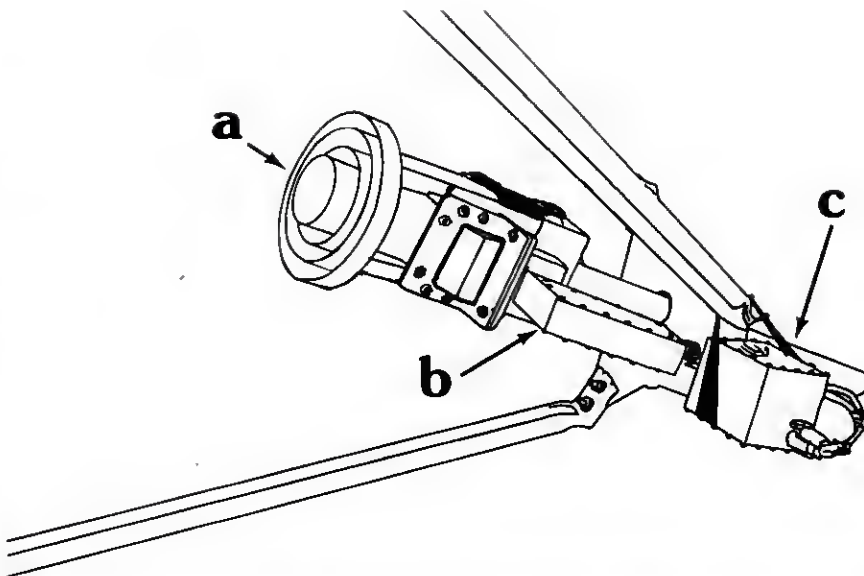


Figure 2. The feed assembly, consisting of the (a) antenna, (b) low-noise amplifier, and (c) downconverter.

lite polarizes all its signals horizontally.

Even though all communications satellites (about 12 currently in operation) broadcast on the same frequencies, there is no interference between them because the receiving antennas are highly directional.

To pick up these signals, you need to rotate your dish antenna. You can equip your antenna with a remote control motor to rotate the dish from inside your house. Other satellite systems provide electronic switches that correctly position the antenna.

Earth transmitters send TV signals to satellites at 1,000 watts. This is called the

uplink of the transmission. The satellite receives the signal, usually at around 6 gigahertz in frequency, cleans it up, and retransmits it back over the United States (see the schematic in Fig. 1).

The return signal arrives at between 3.7 and 4.2 gigahertz and at a power of 5 watts. Because the signal is so weak, you need a large receiving dish to gather and concentrate the signal (see the Photo). For most of North America, a 10-foot dish is the minimum required for a good picture. The dish gathers and concentrates the signal, and bounces it back into the feed assembly, a combination receiver/amplifier suspended opposite the center of the dish (see Fig. 2). The feed assembly directs signals into the receiving amplifier, called a low-noise amplifier, or LNA.

The LNA amplifies the signal and sends it to the downconverter, also part of the feed assembly. The downconverter changes the high-frequency microwave signal to a lower, more manageable signal of about 70 MHz. It then sends the signal along a standard TV cable wire (Radio Shack part number RG-59U) into your home.

Finally, the signal travels indoors to the receiver, letting you select a channel from 1 to 24. You receive the signal through a radio frequency signal (usually on channels 2, 3, or 4) connected to the antenna input of any television. Direct video/audio outputs are included for connection to a video tape recorder or a large-screen projection TV.

Broadcast Scrambling

Potential satellite owners need not worry about spending money for a receiving system that only picks up scrambled signals. As of this writing, scrambling



Photo. One of the authors' microwave antennas.

Program Listing. Satellite guide and site survey program.

```

10 CLS:PRINT@512,"ENTER YOUR CHOICE <S>ITE SURVEY <P>ROGRAM GUIDE
";:GOSUB640:IFIKS="S"THENGOTO1000ELSEIFIKS<>"P"THENGOTO10
20 CLEAR1000:DIN A$(24),S(75):GOSUB500
30 DATA Nickelodeon/Arts,PTL,NGN,Spotlight,The Movie Channel,WTBS,
E.S.P.N. Entertainment & Sports Programming Net,A.E.T.N./Christian
Broadcasting Network,USA Cable Network/C-Span,Showtime,NTV (Music
Television),Showtime
40 DATA Home Box Office,Cable News Network,Cable News Network Headl
ine News
50 DATA HTN Plus/ASCN/National Jewish Television,Cable Neslth Netw
ork,Reuters Monitor Service/Eternal Nord Television,C-Span,Cinemax
,The Weather Channel,Modern Satellite Network/Daytime/HBO/USA Net.
,Cinemax,HBO
60 FORZ=1TO24:READA$(Z):NEXT:CLS
80 PRINT@87,CHR$(176);CHR$(176);STRING$(9,188);CHR$(176);CHR$(176)
90 PRINT@140,CHR$(184);CHR$(190);STRING$(15,191);CHR$(189);CHR$(18
0);CHR$(144)
100 PRINT@210,CHR$(184);STRING$(21,191);CHR$(189);CHR$(144)
110 PRINT@273,CHR$(186);STRING$(24,191);CHR$(144)
120 PRINT@337,STRING$(25,191);CHR$(149)
130 PRINT@401,CHR$(138);STRING$(24,191)
140 PRINT@466,CHR$(139);CHR$(175);STRING$(20,191);CHR$(143);CHR$(1
29)
150 PRINT@532,CHR$(131);CHR$(143);STRING$(15,191);CHR$(143);CHR$(1
35);CHR$(129)
160 PRINT@599,CHR$(130);CHR$(131);CHR$(131);STRING$(7,143);CHR$(13
1);CHR$(131);CHR$(129)
170 PRINT@365,"Earth";
180 REM PLOT SATELLITES
190 SET(0,24):PRINT@513,"Satcom 3";:SET(2,20):PRINT@578,"Comstar D
4";
200 SET(5,33):PRINT@707,"Nestar 5";:SET(11,38):PRINT@774,"Satcom 2
";
210 SET(10,41):PRINT@042,"Anik A3/A2";:SET(20,44):PRINT@976,"Anik
D1";
220 SET(47,46):PRINT@911,"Anik B";
230 SET(64,46):PRINT@993,"Nestar 4";:SET(70,43):PRINT@937,"Comstar
D1/D2";
240 SET(07,40):PRINT@878,"Westar 3";:SET(0,21):PRINT@449,"Satcom F
1";
241 SET(0,18):PRINT@385,"Satcom F5";:SET(96,37):PRINT@017,"Comstar
D3";:REM F5 & D3
242 SET(101,34):PRINT@756,"Satcom P4";:SET(105,31):PRINT@694,"Nest
ar 1/2";:REM F4 & WEST 1/2
250 S=1:REM STAR TWINKLING
260 GOSUB550:X=0
270 FORA=1TO75:B=RND(1024):S=15359+B:C=PEEK(S):IPC>32THENNEXTELSEP
OKES,46:S(X)=S:X=X+1:NEXT
280 TW=RND(X):POKES(TW),32:PDORDE=1TO20:IFINKEYS=" "THENNEXT:PDRES(T
W),46:GOTO200
290 REM SATELLITE DATA VIDEO PAGE
300 CLS:GOSUB550
310 PRINT@120,"SATELLITE","POSITION","COUNTRY"
320 PRINT"-----"
330 PRINT"Satcom F3R","131 degrees","U.S.A."
340 PRINT"Comstar D1","127 degrees","U.S.A."
350 PRINT"Westar 5","123 degrees","U.S.A."
360 PRINT"Satcom F2","119 degrees","U.S.A."
370 PRINT"Anik 3","114 degrees","Canada"
380 PRINT"Anik 8","109 degrees","Canada"
390 PRINT"Nestar 4"," 99 degrees","U.S.A."
400 PRINT"Comstar D2"," 95 degrees","U.S.A."
410 PRINT"Westar 3"," 91 degrees","U.S.A."
420 PRINT"Comstar D3"," 87 degrees","U.S.A."
430 PRINT"Satcom F4"," 83 degrees","U.S.A."
440 GOSUB610
450 REM SATCOM DATA VIDEO PAGE
460 CLS:GOSUB550
470 PRINT:PRINT" Satcom F3R Programming Services For Transponders
1 Through 12"
480 X=194:FORP=1TO12:PRINT@X,P,A$(P):X=X+64:NEXT
490 GOSUB600:GOSUB610
500 CLS:GOSUB550
510 PRINT:PRINT" Satcom F3R Programming Services For Trnsponders
13 Through 24"
520 X=194:FORP=13TO24:PRINT@X,P,A$(P):X=X+64:NEXT
530 GOSUB600:GOSUB610
540 RUN
550 PRINT@7,"SATELLITE GUIDE - Hit any key for more information";
560 RETURN
580 REM

MAKE BORDER

590 A$=STRING$(63,131)+CHR$(191):FORA=1TO12:A$=A$+CHR$(26)+CHR$(0)
+CHR$(191):NEXT:FORA=1TO13:B$=B$+CHR$(191)+CHR$(26)+CHR$(0):NEXT:B
$=B$+CHR$(191)+STRING$(62,176):RETURN

```

Listing continued

is almost nonexistent in the satellite industry. Only Home Box Office has threatened to modify their signal in the future.

Some programming on Canada's Anik satellite is scrambled, but it has technological problems that are so significant that subscribing cable companies have appealed to them to discontinue this practice.

The Latest Developments

Satellites launched since 1982 have more power than previous units. Consequently, picture quality remains high with less efficient (and less expensive) receiving systems.

Because of these advances, great differences exist between equipment performance and cost. You can find dish antennas for around \$1,200 that give

"Satellites launched since 1982 have more power than previous units. Consequently, picture quality remains high with less efficient (and less expensive) receiving systems."

the same performance as those costing in excess of \$10,000. You can install complete systems today for about \$2,000 to \$3,000.

The latest line of receivers on the market are more attractively packaged than those of a few years ago. They also provide new features and innovations.

Richly furnished cabinets, illuminated meters, and digital channel read-outs enhance front panel appearance. Several companies even offer handheld, infrared remote control.

The Program

Our program contains a satellite guide option and a site survey option. The satellite guide option lists all satellites and their position relative to earth, and prints a graphics display. It also lists the 24 TV channels on the Satcom F3R satellite.

The site survey option prompts you for your location and tells you if you



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```

600 PRINT@128,AS;:PRINT@128,BS;:POKE16383,191:RETURN
610 GOSUB550:FORX=1TO200:IFINKEY$=""THENNEXTELSERETURN
620 PRINT@25," ";:FORX=1TO50:IFINKEY$=""THENNEXT
630 GOTO610
640 IK$=INKEY$:IFIK$=""THENGOTO640ELSERETURN
1000 CLEAR100:DEFDBL A-Z
1010 PI=3.141592
1020 R=3963
1030 R=22300
1040 CLS:PRINT@10,"SATELLITE SITE SURVEY PROGRAM":PRINTSTRING$(64,
"-")
1050 PRINT"ENTER THE LONGITUDE OF THE SATELLITE. HOW MANY DEGREES
";
1060 INPUT SO:INPUT"HOW MANY MINUTES ";SN
1070 INPUT"IS IT WEST OR EAST LONGITUDE (ENTER W OR E) ";SB$
1080 SA=SO+SN/60:IF SB$="E"THEN SA=-SA
1090 INPUT"ENTER OISH (ANTENNA SITE) LONGITUDE. HOW MANY DEGREES
";OD
1100 INPUT"HOW MANY MINUTES ";ON
1110 INPUT"IS IT WEST OR EAST LONGITUDE (ENTER W OR E) ";DB$
1120 DA=OD+ON/60:IF DB$="E"THEN DA=-DA
1130 INPUT"ENTER OISH LATITUDE. HOW MANY DEGREES ";TD
1140 INPUT"HOW MANY MINUTES ";TN
1150 TA=TD+TN/60:TA=90-TA
1160 A=ABS((SA-DA)*PI/180)
1170 C=TA*PI/180
1180 CA=SIN(C)*COS(A):TA=SQR(1/(CA*CA)-1)
1190 AA=ATN(TA)
1200 BS=SIN(A)/SIN(AA)
1210 TB=1/SQR(1/(BS*BS)-1)
1220 BB=ATN(TB):BB=BB*180/PI
1230 IF SA>DA THEN TR=180+BB ELSE TR=180-BB
1240 PRINT"THE TRUE BEARING (ANTENNA READING) IS ";
1250 PRINTUSING"###.##";TR
1260 X=SQR(R*R+(R+R)*(R+R)-2*R*(R+R)*COS(AA))
1270 SE=(R+R)*SIN(AA)/X
1280 TE=1/SQR(1/(SE*SE)-1):EL=ATN(TE)
1290 EL=EL*180/PI
1300 EL=90-EL
1310 PRINT"THE ANGLE OF ELEVATION IS ";
1320 PRINTUSING"###.##";EL;:PRINT" DEGREES"
1330 PRINT:INPUT"HOW MANY DEGREES IS THE MAGNETIC DEVIATION OF YOU
R AREA ";MO
1340 INPUT"IS THAT WEST OR EAST (ENTER W OR E) ";AS$
1350 IFA$="W"THEN MD=MD+TR ELSE MD=TR-MD
1360 PRINT"YOUR COMPASS READING SHOULD ";USING"###.##";MO;:PRINT"
DEGREES"
1370 INPUT"BIT <ENTER> FOR MENU ";OL$:RUN

```

can place a satellite receiving station on your property by calculating the heading and elevation of a dish for any given satellite.

The program first prompts you with a menu containing the two options. Hit the S key to perform a site survey or the P key for a satellite programming guide.

The satellite guide section presents a visual picture of the earth, with current satellites in their respective positions. The program displays information about the various satellites, including their longitude (true position) and their country of origin.

There must be an unobstructed line from your dish to the satellite. In the winter, trees have no effect on microwaves, but the addition of water in foliage in the spring and summer wipes out reception.

The mathematics used in the program involve spherical trigonometry and is beyond the scope of this article.

Data Input

It's easy to accurately determine the

latitude and longitude of your house by checking a map or referring to the deed to your house. You must also input the magnetic deviation (the difference between true north and magnetic north) in your area. You can get this information from your local airport or, if you live along the coast, from the local Coast Guard base.

Enter the longitude of the satellite you wish to find by copying the information from the satellite guide section in the program. Enter fractional degrees using either a decimal point or by answering the prompt for the number of minutes of arc. For example, if your latitude is 74 degrees, 50 minutes, you can enter this into the program in two ways:

```

ENTER DISH (ANTENNA) LONGITUDE
HOW MANY DEGREES? 74.8
HOW MANY MINUTES? 0

```

or

```

ENTER DISH (ANTENNA) LONGITUDE
HOW MANY DEGREES? 74
HOW MANY MINUTES? 50

```

Installing It Yourself

If you're interested in purchasing your own satellite receiver, we suggest you talk to your local satellite dealer. Unless you're mechanically inclined, a site inspection for reception quality, and siting the antenna should be done by a professional.

With a distance of 22,300 miles from satellite to the equator, an antenna situated off by 1 degree will miss its intended satellite by 1,000 miles. A preliminary inspection will save you a lot of wasted effort in an area of poor reception.

By running your own cable, pouring the concrete, and assembling the equipment yourself, however, you can save hundreds of dollars.

We purchased a Wilson Microwave system. The Wilson system is not a turnkey system; that is, the manufacturer does not supply all the material necessary to put the system into operation, but only a few connectors and some wire aren't included.

The wire is standard multiconductor cable. It runs the power supplied by the indoor receiver out to the low-noise amplifier and downconverter. You also need an RG-59U wire to bring the TV signal from the downconverter into the house. You can purchase both types of wire at Radio Shack.

One person cannot install this system alone. Laying the concrete foundation for the dish and assembling its panels are two-man operations.

An 11-foot dish has a surface area of 95 square feet. On a 100-square-foot area, an 80 mph wind exerts a 2½ ton force. This kind of stress makes a secure base essential.

Conclusion

In retrospect, the expense we incurred to construct a working earth satellite receiver system was higher than originally estimated. Several nuts and bolts, two special microwave connectors (available from a satellite system dealer), and wire and cables all were additional expenses.

The system is fairly easy to operate, although you have to adjust the fine tuning every time you change stations.

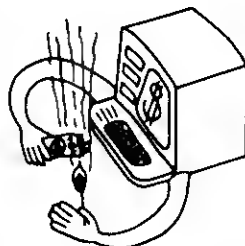
During heavy rain, we pick up some snow on the picture, but other than that, picture quality is good.

What's on TV tonight? Everything! ■

Dan Keen and Dave Dischert can be reached at Soft Horizons Computer Software, RD1 Box 432, State Highway 83, Cape May Court House, NJ 08210.

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The use of 'ISAM' files is not the only time saver, as compiler basic programs run considerably faster than ordinary basic programs. For example: the loan amortization system was programmed in compiler basic just to speed up the time it takes to calculate the loan payments and produce the amortization report.

Both versions of our inventory system are programmed in interpreter basic, utilizing both direct access and variable length records to maximize access speed and the use of available disk space.

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Builds and maintains user defined data file(s) with up to 16 (12 for model III) user defined data fields. The user specifies file name, control field data, data field names, and data field size. The system adds records, changes records, deletes records, displays individual records, prints all records in user defined format with user's choice of fields and order, and prints records by user defined search as to field and value in user defined format with user's choice of fields and order.

Model 2, 12 \$295.00
Model III \$275.00

MAILING LIST SYSTEM (Alpha Sequence)

Builds and maintains mailing list in alpha sequence by entire name. The system adds records and checks for duplicates, changes records, deletes records, displays individual records, prints all records, prints records by user specified zip code search, prints all mailing labels, prints individual labels (as many as requested), prints labels by user specified zip code search, & prints telephone directory. The data file created by this system can be used as input for the mailing list (zip code sequence) system.

Model 2, 12 \$200.00
Model III \$175.00

MAILING LIST SYSTEM (Zip Code Sequence)

Builds and maintains mailing list in alpha sequence within zip code sequence. This system adds records and checks for duplicates, changes records, deletes records, displays individual records, prints all records in alpha sequence within zip code, prints records by user specified zip code, prints all mailing labels in alpha sequence within zip code, prints individual labels (as many as requested), prints labels for user specified individual zip codes, prints telephone directory in alpha sequence within zip code, and reads in file(s) created by mailing list (alpha sequence).

Model 2, 12 \$250.00
Model III \$225.00

LOAN AMORTIZATION

Calculates personalized loan payments and interest. User specifies loan amount, interest rate, and length of loan. Displays monthly payment, displays monthly analysis, displays totals, prints monthly payments, prints monthly analysis, and allows user to enter over ride of monthly payments and recalculate totals and print or display monthly analysis.

Model 2, 12 \$125.00
Model III \$115.00

INVENTORY CONTROL SYSTEM (Retail, Wholesale, Manufacturer)

Builds and maintains records on all in stock items. Records contain user's part number, manufacturer's part number, on order quantity, in stock quantity, reorder point, wholesale price, retail price, sales history for preceding month, year, same month last year, this year to date, last year to date. Displays individual item record, prints complete record for all items, and prints suggested purchase order. The add routine checks for duplicates.

Model 2, 12 \$275.00
Model III \$225.00

DESK CALENDAR

Each month prints on 14" x 11 paper. Each day is blocked to allow appointments entry. User specifies beginning month and number of months and number of calendars to be printed. 4 lines of user information may be printed on each month which makes it useful as an advertising media.

Model 2, 12 \$49.95
Model III \$49.95

WALL CALENDAR

Each year prints on 8 1/2" x 11 paper. User specifies beginning month and number of calendars to be printed. 4 lines of user information may be printed on each month which makes it useful as an advertising media.

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Model III \$49.95

For Additional Information Send for User Documentation — \$15.00 per copy.

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Model 2, 12 64k 1 Disk

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★★★½

212A/D Direct Connect Modem
Universal Data Systems
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Huntsville, AL 35605
\$745

These three direct-connect modems offer attractive alternatives to meet the

Choose one of these modems and get the right communication ability for your applications.

need to transmit information from your computer over telephone lines. They differ significantly in price and capabilities, but one of them is likely to suit your needs.

Each of the three modems works well and does all that it's supposed to. If you can get along with a 300 baud modem, the J-Cat is hard to beat in terms of price and performance. It's small, works perfectly, and is about as inexpensive a modem as you can buy.

If you need a 1,200 baud modem, in

addition to or instead of 300 baud operation, the Smart Cat offers a near-perfect alternative. It's remarkably small, offers all the features you're likely to need, and is competitively priced.

Alternatively, if you want a modem that can handle any 300 or 1,200 baud operation you might encounter, the UDS 212A/D is an excellent choice. It offers all the flexibility you're likely to need, is easy to operate, and includes diagnostic capabilities to isolate communications problems on the line, in the modem, or in the terminal equipment. All in all, it's a good product for commercial or industrial applications.

Table 1 summarizes major features. Which modem you choose depends on your finances and applications.

The three modems differ radically in size. The Novation J-Cat is scarcely larger than a pack of cigarettes. Its more capable companion, the 103/212 Smart Cat, resembles a tall paperback book. The UDC 212A/D, clearly intended for commercial use, has a footprint that is almost 3/4 of a square foot!

The J-Cat and UDC units are housed in plastic cases and the Smart Cat comes in a nonmagnetic metal case. All the units should retain their physical integrity in any ordinary use.

A conventional plug-in wall transformer powers the two Novation modems. The UDC unit has an integral alternating current (ac) power supply.

Neither of the Novation units has an on/off power switch, an unfortunate omission. The power requirements of these modems are nominal, however, ranging from 7-13.5 watts, so it's feasible to leave them turned on all the time.

J-Cat

The J-Cat is a simple, full duplex, 300 baud modem that has surprising capa-

Feature	J-CAT	103/212 Smart CAT	UDS 212A/D
Size (Inches)	5.0 x 1.9 x 1.3	10.0 x 4.7 x 1.2	10.85 x 9.76 x 2.42
Baud Rates	300	300/1200	300/1200
Auto Dial	See Text	Yes	Yes
Manual Answer	Yes	Yes	Yes
Auto Answer	Yes	Yes	Yes
Keyboard Dial	No	Yes	Yes
Manual Redial	Yes	Yes	Yes
Auto Redial	No	Yes	Yes
Dial Modes	See Text	Pulse/MFTD	Pulse/MFTD
Memory	None	Last #	5 #'s + Last #
Asynchronous	Yes	Yes	Yes
Synchronous	No	No	Yes
Resettable Defaults	No	Yes	No
Self Test	No	Yes	Yes
Analog Loopback	Yes	Yes	Yes
Local Digital Loopback	No	Yes	Yes
Remote Digital Loopback	No	Yes	Yes
Phone Jack(s)	RJ11C	RJ11C	RJ11C/RJ455
Power (Watts)	8.0	13.5	7.0
Power Supply	Wall XFMR	Wall XFMR	Internal
Power Switch	No	No	Yes
Status Response	LED	DISPLAY	DISPLAY
Phone Service	1*	1*	1, 2, 3*
Cables Provided	All	Phone Line	Phone Line
Price	145.00	595.00	745.00

*Phone Service: 1 - Permissive, 2 - Programmable, 3 - Private Line

Table 1. Summary of modem characteristics.

bility in spite of its tiny size. You operate it with two push buttons; it has two LEDs that indicate its status. One push button puts the modem on line; the second disconnects it. Pressing the two buttons simultaneously puts the modem in analog loopback mode, so that its output connects to its input—an invaluable test to verify its operation.

You select auto answer or manual answer modes with a slide switch on the back of the unit. The two LEDs indicate when the modem is off-hook and ready for operation.

Although the J-Cat is not directly usable in auto-dial mode, you can implement auto pulse dialing with dial tone detect if 1 input and 1 output bit are available from another port. The operations manual provides a simple program to implement directory dialing and automatic redial using these bits. The program is written in Applesoft Basic but you can readily adapt it to Microsoft Basic.

The J-Cat is relatively unique among modems in providing automatic mode selection. When on line, the modem alternates between originate mode for two seconds and answer mode for four. As soon as it detects a carrier, the modem locks in its current mode. This relieves the user of any concern for selecting the modem's operating mode—a very useful feature.

The J-Cat comes with all the required cables, including one terminated with a female RS-232C D-connector that plugs into the output of your serial interface. A Y cable is also provided; one end of it plugs into the phone line via an RJ11C plug. The other leg of the Y terminates in a socket that accepts the RJ11C plug on the telephone.

You don't need to buy anything else. Simply hook up the modem according to the clear directions in the operations manual, load your terminal program, and you're ready to communicate.

The J-Cat's operating manual is a 4¼- by 9½-inch booklet of 21 pages that is clearly written and provides all the necessary information to install and operate the modem. A schematic is included, with detailed pin-outs for the connectors on the back of the unit.

103/212 Smart Cat

The 103/212 Smart Cat is the J-Cat's big brother. In addition to operation at both 300 and 1,200 baud, the user-programmable Smart Cat provides numerous operating conveniences.

In normal operation this modem has no visible controls. You select all operating modes by entering commands

from the terminal or computer keyboard. As a consequence, you can tuck the modem away from the operating position in the most convenient location. You can even place it inside a piece of equipment if the thermal environment isn't severe.

The Smart Cat has five option switches located behind its front panel. These are readily accessible if you pry the panel off with a small screwdriver. Once you set them, these switches will not normally need resetting.

Switch 1 sets the command mode. It determines the character you must send from the terminal to indicate to the modem that a command follows. Normally, the percent sign is the command indicator. By using the option switch, you can select any other character, including a control character, and substitute it for the percent sign. You terminate all commands with a carriage return.

Switch 2 sets the response mode and gives the user the option of receiving modem responses on the terminal screen in full English words or in the terse mode as single characters.

Switch 3 sets the data rate to which the modem is automatically set when you turn on the system. Naturally, you can change the rate afterward from the terminal keyboard.

Switch 4 enables or disables the auto answer mode. You cannot subsequently reset this switch selection from the keyboard.

Switch 5 determines whether the modem senses the Data Set Ready (DSR) and Clear To Send (CTS) lines all the time or only after detection of a carrier on the phone line.

You maintain normal control of the Smart Cat with 21 commands that you can enter directly from the terminal or computer keyboard. Depending on the type of command, some have arguments and/or default values.

Initialize puts the modem in its normal working state, while Hangup disables the modem, waits three seconds, and hangs up the phone. You cannot receive data during the three-second wait.

Dial, followed by a string of up to 32 characters, takes the phone line off hook and dials in accord with the character string contents. Allowable characters comprise 0-9, #, *, 1, P, and W. 1 indicates that the modem generates telephone pulses rather than tones until the next P or W.

P forces a wait for a dial tone; if no dial tone occurs in five seconds, the modem hangs up and gives a No Dial

response. W forces a five-second wait before the modem begins dialing.

You can use another dialing command, Count, followed by an integer, to determine how many rings the modem waits for before aborting a call. Redial dials the last number at intervals of 40 seconds until you reach the number or you've dialed it 10 times.

Voice puts the modem in voice mode, and Modern puts it in data mode. Pickup puts the phone line off hook, and also puts the modem in voice mode. Answer and Originate put the Smart Cat in answer or originate mode, respectively; they both take the phone line off hook. You must follow the last mode command, Giveback, with zero or 1 to put the modem in full or half duplex mode 1, respectively.

Speed, followed by 1 or 2, sets the

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modem speed to 300 or 1,200 baud. In answer mode, the modem automatically sets itself to the incoming data's speed, irrespective of speed selection.

Follow New with a single ASCII character to substitute that character for the current command character. Use Echo followed by zero or 1 (with a default of zero) to enable (zero) or disable (1) the echo of commands back to the terminal. The modem does not echo data.

Query forces the modem to return a single character that describes its status. Long, followed by zero or 1, causes the modem to provide full English (zero) or single-character (1) responses. Break, followed by an integer n, sends a space on the phone line. The length of the space is n times 250 milliseconds.

With the modem in voice mode, XMIT followed by a phone number transmits the DTMF tone pairs corresponding to the given number.

Follow Unlisten with a one- to four-character hexadecimal (hex) argument to transmit the number of bytes given by the hex argument as data. This permits transmission of data that the modem would otherwise interpret as command strings.

Format followed by a single-character argument establishes the number of data and stop bits, and the parity of data transmitted over the phone line. The allowable arguments and their interpretations are shown in Table 2.

Test, followed by an integer from zero to 3, selects, respectively, hardware integrity, analog loopback, remote digital loopback, or local digital loopback test modes. The hardware integrity test also occurs automatically when you turn on the machine. It verifies the modem's operation and correct connection of the RS-232C cable.

The responses the Smart Cat provides are clear and easy to understand. Ring

indicates that the modem detects a ring-back tone, and Busy indicates a busy signal. No Dial, CONN Lost, and No ANS are self-explanatory, although the No ANS occurs only after the specified number of rings.

UNSUC means that for some unspecified reason the modem cannot complete the call. Ready means that carrier is acquired and communication established. Ring In tells you the modem detects an incoming ring. Finally, OK tells you that your last command is complete and the modem is ready for another.

While this description sounds complicated at first reading, operating the Smart Cat becomes second nature with a little use. The operations manual, identical in size to that of the J-Cat, is only slightly longer, yet it provides a fully adequate description of all the modem's operational and test features.

The Smart Cat package includes the wall mount power transformer and a cable to connect the modem to an RJ11C phone jack. An RJ11C socket on the back of the modem lets you plug the telephone directly into the unit.

The manufacturer provides no RS-232C cable, so you have to make one up yourself or buy one ready-made. The manual describes the necessary pin-out details at the cable's modem end. You have to determine the corresponding pin-outs at the serial connector on your terminal or computer.

UDS 212A/D

The UDS 212A/D includes most of the features available in the Smart Cat as well as a number of others that make it a natural selection for system houses that want to carry only a single modem that can be configured to meet most communications needs.

Additional features available in the 212A/D include selectable permissive or programmable transmit levels, operation with private phone lines, optional synchronous operation at 1,200 baud, battery-backed memory for five 30-character dial strings, and capability to wait for a second dial tone. The modem also displays and edits stored dial strings, and has a Help command to display and describe commands.

The 212A/D is built on two circuit boards. The top board contains the modem circuitry, and the bottom the automatic calling unit (ACU) and the power supply. DIP (dual in-line package) switches on the top board permit setting a variety of options.

These include forced answer, forced

originate modes, and private line operation. You can disconnect on long receive or transmit space, loss of Data Terminal Ready (DTR), or loss of carrier. The 212A/D also has auto answer always or only when DTR is enabled, synchronous or asynchronous operation, and 9-, 10-, or 11-bit characters (including stop bits).

Strapping options on the board permit grounding or ungrounding the modem chassis; selecting internal, external, or slave transmit clock options; and selecting permissive or programmable transmit levels. A DIP switch on the lower board enables or disables the automatic calling unit.

In operation, you should think of these option selections as permanent, since you must remove the modem cover to change them—not something you care to do often.

The 212A/D starts up in initialization mode. It expects to receive an uppercase, two-character string, EN, from the terminal or computer. The modem uses this input to establish the operational character rate and data format. After it receives EN, the modem responds with:

```
(CR) (LF)
UDS 212 DIALER
(CR) (LF)
:
```

The colon is the prompt from the ACU and indicates that the unit is ready to receive commands. Eleven commands, input as single, uppercase letters, are available to control the operation of the ACU.

H, the Help command, displays a brief summary of the available commands on the terminal or computer screen.

D lets you dial a telephone number directly from the keyboard. You can specify a number of up to 30 characters long containing both digits and operators. Five operators are available: W, D, E, A#, and space. W in the dial string causes the ACU to wait for a second dial tone. This important feature permits use of the modem with alternative carriers such as MCI, Sprint, and so on.

D in the dial string introduces a pause of 1.5, 3.0, or 4.5 seconds in the dialing operation. You select the length of the pause. E at the end of the dial string immediately terminates the calling sequence and connects the telephone to the phone line for voice communication.

A#, after all other digit entries and where # is a digit from 1 to 5, takes the dial string from the memory register

Argument	Stop Bits	Data Bits	Parity
0	1	7	Mark
1	1	7	Space
2	1	7	Odd
3	1	7	Even
4	1	8	None
8	2	7	Mark
9	2	7	Space
A	2	7	Odd
B	2	7	Even
C	2	8	None

Table 2. Format allowable arguments and interpretations for the Smart Cat.

identified by # to complete the original dial string. The space character is purely a cosmetic operator to improve the string's readability.

ACU command L, followed by a digit from 1 to 5, loads any of the five memory registers with a dial string. The ACU repeats the loaded string back to the CRT and returns to command mode with the display of the : prompt. P, the Print command, displays the contents of all loaded memory registers on the screen.

C, followed by a digit from 1 to 5, clears the contents of the correspondingly numbered memory register. If C is followed by the character L rather than a digit, all memory registers clear. Where # is a digit from 1 to 5, # causes the ACU to dial the dial string in the memory register identified by #.

R redials the last number dialed, and X redials the last used dial string continually until the modem detects an Answer Back Tone.

Q, the Quit command, aborts any ACU operation. B takes the phone line off hook, and N cancels the B command and returns the phone line to on hook status.

A primitive, although entirely adequate, editing capability lets you correct mistakes made when you enter dial strings from the keyboard. Enter the character @ to delete the last character entered. If you enter several @ characters, the program deletes the corresponding number of previous keyboard entries.

The 212A/D provides simple English responses to the terminal or computer screen to indicate the status and disposition of ACU actions. These are self-explanatory and include such responses as Off Hook when you initiate dialing, No D.T if the modem detects no dial tone, echo of the number dialed, No ABT if the modem receives no Answer Back Tone, and Busy, Complete, or Abort to indicate call disposition.

In addition to the options you set on the modem board itself, you can set six more options from the keyboard. OA#, where # is zero or 1, requires dial tone detection before dialing (zero) or waits four seconds and then dials (1) even though no dial tone is present. Zero is the default.

OB# provides pulse dialing, the default, where # is zero and multifrequency tone dialing where # is 1. OC# provides DSR active if # is zero, the default, or inactive if # is 1.

OD# sets the wait time before an unsuccessful dialing attempt aborts. Values of # from zero to 4 give wait times from 15 to 75 seconds. The de-

fault is 30 seconds. OE# sets the delay produced by the D command in a dial string. Values of # from zero to 2 give delays of 1.5 to 4.5 seconds. Three seconds is the default.

OF# lets you turn on or off the echo of commands back to the screen. A value of zero for # turns off the echo and 1 turns it on. Echo On is the default. OG0 reinitializes the modem to its start-up condition and requires entry of the initialization sequence EN to enable the automatic calling unit.

While it is convenient to set some of the modem parameters with the OA-OF commands, whatever settings you've established are lost if you turn off the modem or reinitialize it by using OG0.

Finally, six buttons on the modem's front panel provide the last remaining elements of control. Four of these activate a modem self-test or the three loopback test modes. A fifth forces the modem into 1,200 baud mode, and the sixth puts the telephone set on or off line.

Overview

All the modems are covered by a one year warranty on parts and labor. None of them is readily repairable by the user, nor is this recommended.

You must return the two Novation modems to the factory for repair. You can have the UDS modem repaired at the factory or at a number of authorized service locations. Since none required service as I prepared the review, I don't have information on the turnaround time for repair.

Reliability of the Novation units should be very good since they use a high degree of integration—the J-Cat has four integrated circuits and the Smart Cat has only a few more.

The UDS 212A/D might be very reliable as well, but the extraordinary parts count is a potential source of worry—the modem board alone has 83 integrated circuits!

None of the three modems comes with communications software. I operated all of them for test purposes with the Lobo Max-80 using both the COM-M/CMD terminal program that is integral with LDOS and SMODEM, a recent version of the widely available, public domain MODEM7, operating under CP/M 2.2.

I accessed CompuServe and several local bulletin board systems at both 300 and 1,200 baud (only 300 baud for the J-Cat) to verify the modems' operational features. Each performed exactly as represented in the respective manuals,

and I encountered no problems of any kind.

Most of my complaints are minor. The J-Cat's remarkably small size makes you wish you could tuck it inside a terminal or a computer case. Unfortunately, you must use the unit's push buttons to put it on line and back off line. It's also aesthetically annoying that the label on the face of the modem is printed upside down.

The Smart Cat leaves little room for complaint. It does what it's supposed to do and does it well, although it would be nice to have a power switch.

The UDC modem has some problems. As I mentioned, you must take the cover off to set the character size. This is a minor annoyance that becomes a major one when you remove the cover and the front panel falls off. It turns out to be devilishly difficult to get back in place.

A more serious problem exists with the telephone set. Although you can plug the phone into the back of the modem and activate it with the talk switch on the front panel, you can't use the phone at all unless the modem is turned on.

It is also unfortunate that, although you can reset a number of modem parameters from the keyboard, you can't reset the defaults for these parameters and you are returned to the built-in defaults whenever you turn off or reinitialize the modem.

The UDS manual deserves special mention. Unlike the manuals for the Novation units, the UDS manual tells you both too much and too little. It is full of acronyms, usually defined long after they are first introduced if they are defined at all.

It tersely describes the bewildering array of available options that you can set or strap on the modem board, but you get no guidance as to what options you should select in what circumstances. An entire chapter is devoted to "theory of operation," but after reading it you know nothing useful about the modem.

Last, although the battery-backed memory for dial strings is a convenience and works perfectly, I can't understand why, with the low price of CMOS memory, storage is provided for only five numbers. Except in dedicated service, five numbers don't seem to be enough. ■

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Real World Control—Part II

by David L. Engelhardt

Use your Model III to control a burglar alarm, sprinkler system, or other household device. These programs work with the hardware in Part I.

This is the second of a two-part article for advanced builders to utilize a real-world interface and clock to operate a burglar alarm and sprinkler system with room for other real-world applications.

The four Assembly-language programs in this article let you implement home control devices through your Model III, a real-time clock, and the input/output (I/O) board described in Part I (November 1983, p. 216).

After you build and test your I/O board, you're ready to program your computer to take over some mundane household chores.

Clock Program

Program Listing 1 is almost identical to the one in "Real World, It's About Time" (80 Micro, March 1983, p. 342). I made a few slight changes to allow a relationship with the sprinkler and bur-

glar alarm programs. The principal addition is the patch in lines 1270-1320. If activated, the sprinkler and burglar alarm programs patch themselves here.

These patches contain a jump address to the scan sections of the appropriate program. The clock's one-second interrupts trigger one-second scans of each program. If either or both of the programs become deactivated, they disengage themselves from the clock's patch region.

Burglar Alarm Program

Program Listing 2 is heavily commented. When executed, the program prompts you with specific questions regarding system status and locations where the alarm system is activated. I'll describe some of its basic functions below.

When you run the program, it indicates its status and asks for the code word allowing it to swap its state. The code word I used is Mom, but you can change it. The program shows each location where the alarm is on. This lets you decide which point to deactivate when you turn off the system.

An alarm system must allow time for you to exit and enter the building before the siren sounds. In this case there is a two-minute exit delay and a 30-second entrance delay. Two minutes after you leave, the system activates itself and starts scanning all of the activated alarm points. Upon entering, you must deactivate the system within 30 seconds or the

Program Listing 1. Clock Initialization.

```

00010 ;CLOCK INITIALIZATION AND INTERRUPT READ PROGRAM
00020 ;WRITTEN BY DAVE ENGELHARDT 3/15/82
00030 ;SAVE MEMORY SIZE OF -32447- (THIS WILL ALLOW ROOM
00040 ; FOR PATCHING IN FUTURE
00050 ; PROGRAMS.)
00060 ;EXECUTE WITH A /32448
00070 ;
00080 ; INITIALIZATION SECTION
00090 ;
00100 ORG 7EC0H ;INITIALIZATION SECTION
00110 DEFW 00H ;SPARE
00120 BEGIN DI ;DISABLE INTERRUPTS
00130 LD A,12 ;USED TO SET INTERRUPTS
00140 LD (4213H),A ;ENABLE EXT INTERRUPTS
00150 LD HI,START ;LOAD START OF CLOCK
00160 LD (403EH),HL ; TO INTERRUPT VECTOR
00170 LD A,16
00180 OUT (0ECH),A ;ENABLE TRS MAIN BUS
00190 LD A,128 ;SET UP 8255 FOR
00200 OUT (SETUP),A ; MODE 0
00210 XOR A
00220 OUT (OUTC),A ;MAKE SURE PC7 IS OFF
00230 OUT (0ECH),A ;SHUT OFF MAIN BUS
00240 IM 1 ;SET MODE 1 INTERRUPT
00250 EI ;ENABLE INTERRUPTS
00260 EXI JP 1A19H ;BACK TO BASIC
00270 ;
00280 ;
00290 INPUTA EQU 30H ;USED TO CONTROL CLOCK DATA LINES
00300 OUTB EQU 31H ;USED TO CONTROL CLK ADDRESS LINES
00310 OUTC EQU 32H ;USED TO CONTROL CLK FUNCTIONS
00320 SETUP EQU 33H ;USED TO CONFIGURE 8255
00330 ;
00340 ; CLOCK INTERRUPT/READ PROGRAM
00350 ;
00360 START PUSH HL ;SAVE REGISTERS
00370 PUSH DE
00380 PUSH BC
00390 PUSH IX
00400 PUSH IY
00410 PUSH AF
00420 LD A,16 ;VALUE FOR TRS BUS

```

Listing 1 continued

The Key Box

Model III
16K RAM Cassette Basic
32K RAM Disk Basic
Assembly Language
Editor/Assembler

siren sounds.

Upon re-entry to the program, you must enter the code word to deactivate the system. It allows three attempts to enter the code word correctly. In case of a code entry error, the program jumps back to Basic. I label user-changable parameters in the listings. Just remember to keep the time delay parameters in units of seconds.

Also, in regard to the time delays, note that I allow two points in Port 2 for entry time delays. I label these in the listing under the individual alarms. If you need more points, double up some of them so that one point covers two doors.

In case of an illegal entry, the program sounds a buzzer attached to Port 1, bit 16. This buzzer turns on and off for 30 seconds prior to activation of the main siren. The siren stays on for two minutes then shuts off. After a 30-second wait, the program checks its status again and recycles if an alarm condition still exists.

There are also provisions in the program to make sure the relays shut off when they should. If the relay isn't off or fails to turn off the first time, there is one last attempt to shut it off. The system turns on the buzzer and prints an error message to attract your attention.

This is usually the result of a hardware problem. The relay may actually shut off but the indication read back is in error. An asterisk blinks once a second in the upper right-hand corner indicating the system is active.

I designed this system to be simple to use, fairly burglar proof, and adaptable to your needs. It is not a guarantee of protection but only part of a home protection plan.

Sprinkler System Program

In Program Listing 3, I designate four sprinkler zones. It starts with a menu offering four options: Auto, Manual, Go, and Exit. This program is self-explanatory, but I'll briefly describe each mode.

The Auto mode patches the scan section of this program into the clock program. Once this is done, the program checks the time of day (am/pm), day code, and time to start. You can change this to suit your needs. When this mode starts, each zone runs for 15 minutes for a total of two cycles. The Go mode is the same as the Auto mode except that it starts on your request.

The Manual mode lets you turn on any zone for up to a maximum of 39 minutes. The program checks for illegal

Listing 1 continued

```

00430 OUT      (SECR) ,A      ;ENABLE MAIN BUS
00440 LD      A,144        ;SET B255 FOR CONTROL
00450 OUT      (SETUP) ,A  ;CONFIGURE B255
00460 LD      A,1         ;SET UP FOR READ
00470 OUT      (OUTC) ,A   ;PORT C FOR READ
00480 LD      C,OUTB      ;C IS USED FOR OUT INSTR.
00490 LD      B,12        ;USED TO ADDRESS COUNTERS
00500 LD      H,*,BUFFER  ;START OF TIME STORAGE
00510 CALL    GET         ;GET Y10
00520 CALL    GET         ;GET Y1
00530 LD      (HL), '/'    ;PUT / IN WORD
00540 INC     B            ;INC TO NEXT LOC IN BUFF
00550 CALL    GET         ;GET M10
00560 CALL    GET         ;GET M1
00570 LD      (HL), '/'    ;PUT IN SEPARATOR
00580 INC     HL           ;INC TO NEXT POSITION
00590 CALL    GET         ;GET D10
00600 BIT     2,A          ;IS LEAP BIT SET?
00610 JR      Z,GETD1     ;SKIP OF NOT SET
00620 AND     33H         ;STRIP OFF LEAP BIT
00630 DEC     HL          ;BACK UP 1 POSITION
00640 LD      (HL),A       ;PUT CORRECT VALUE IN
00650 INC     HL           ;INC TO NEXT POSITION
00660 GETD1  CALL    GET   ;GET D1
00670 CALL    FILL        ;INSERT 2 SPACES
00680 CALL    GET         ;GET DAY DIGIT (0-6)
00690 AND     07H         ;MASK FOR DAY CODE
00700 LD      (DIGIT) ,A  ;SAVE FOR SPINKLER PROG
00710 DEC     HL          ;RE-ALIGN BDFP PTR
00720 LD      DE,SD       ;GET ADDRESS OF TABLE
00730 RLA          ;SHIFT FOR 2 WORD OFFSET
00740 ADD     A,E         ;ADD DAY INDEX TO A
00750 LD      E,A         ;PUT INDEX TO A REG
00760 PUSH    BC          ;SAVE PORT & ADDRSS CONTRL
00770 LD      A,(DE)       ;GET PTR TO DAY CODE
00780 LD      (TEMP1) ,A   ;SAVE LSB OF DAY CODE
00790 INC     DE           ;INDEX TO GET NEXT PTR
00800 LD      A,(DE)       ;GET NEXT PTR TO DAY CODE
00810 LD      (TEMP2) ,A   ;SAVE MSB OF DAY CODE
00820 LD      DE,(TEMP1)  ;GET ADDRESS OF DAY
00830 EX      DE,BL       ;SWAP PTRS FOR LDIR MOVE
00840 LD      BC,3        ;SET CTR TO MOVE 3 BYTES
00850 LDIR    ;MOVE IT
00860 EX      DE,HL       ;RESTORE PTRS.
00870 POP     BC          ;RESTORE PORT & ADDRESS'S
00880 CALL    FILL        ;FILL WITH SPACES
00890 CALL    GET         ;GET H10
00900 DEC     H1          ;SET BACK BUFF PTR
00910 PUSH    AF          ;SAVE A REG FOR AM CHECK
00920 AND     33H         ;MASK FOR H10 VALUE
00930 LD      (HL),A       ;PUT H10 VALUE TO BUFFER
00940 INC     H1          ;NEXT BUFFER LOCATION
00950 CALL    GET         ;GET H1
00960 LD      (HL), ':'    ;PUT IN COLDN
00970 INC     HL           ;NEXT BDFP LOCATION
00980 CALL    GET         ;GET M10
00990 CALL    GET         ;GET M1
01000 LD      (HL), ':'    ;PUT IN COLON
01010 INC     HL          ;NEXT BUFFER LOCATION
01020 CALL    GET         ;GET S10
01030 CALL    GET         ;GET S1
01040 CALL    FILL        ;FILL WITH SPACES
01050 POP     AF          ;RESTOR AM/PM INFO
01060 BIT     3,A          ;IS THIS 24 HOUR FORMAT?
01070 JR      Z,AMPM      ;SKIP AM/PM DISPLAY SECT
01080 CALL    FILL        ;BLANK WHERE AM WAS TO BE
01090 JR      DISPLAY     ;GO AND DISPLAY TIME
01100 AMPM   BIT     2,A   ;IS PM BIT SET?
01110 JR      NZ,PM       ;PM BIT SET
01120 AM     LD      (HL), 'A'
01130 JR      CONT        ;AM CODE
01140 PM     LD      (HL), 'P'
01150 CONT   INC     HL   ;INC TO NEXT BUFFER PTR
01160 LD      (HL), 'M'   ;PUT IN THE M FOR AM/PM
01170 DISPLAY LD      M,*,BUFFER
01180 LD      DE,3C24H    ;BEGIN OF TIME INFO
01190 LD      BC,27       ;DESTINATION TO SCREEN
01200 LDIR    ;NUMBER OF TIME WORDS
01210 NODISP LD      A,15 ;MOVE THE TIME TO SCREEN
01220 OUT      (OUTB) ,A  ;FOR CLOCK ADDRESSES
01230 LD      A,129      ;SET ADDRESS LINES HIGH
01240 OUT      (OUTC) ,A  ;SET READ HIGH-ENABLE INT
01250 XOR     A          ;TURN ON INTERRUPTS VIA PC7
01260 OUT      (SECH) ,A  ;CLEAR A REG
01270 WATER  NOP         ;TURN OFF TRS MAIN BUS
01280 WATER1 NOP         ;THIS IS WHERE
01290 WATER2 NOP         ; THE SPRINKLER SYSTEM
01300 BURG   NOP         ; IS PATCHED IN.
01310 BURG1  NOP         ;THIS IS WHERE
01320 BURG2  NOP         ; THE BURGLER ALARM
01330 POP     AF          ; IS PATCHED IN.
01340 POP     IY          ;RESTORE REGISTORS
01350 POP     IX
01360 POP     BC
01370 POP     DE
01380 POP     HL
01390 EI
01400 RET
01410 ;
01420 ;
01430 ;
01440 SU      DEFW      SUN
01450 MO      DEFW      MON
01460 TU      DEFW      TUE
01470 WE      DEFW      WED

```

Continued on p. 158

Listing 1 continued

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Listing 1 continued

```

01480 TR      DEFW  THR
01490 FR      DEFW  FRI
01500 SA      DEFW  SAT
01510 ;
01520 ;
01530 DIGIT   DEFB   00      ;USED FOR SPRINK DAY CODES
01540 TEMP1   DEFB   0      ;LSB STORAGE FOR DAY
01550 TEMP2   DEFB   0      ;MSB STORAGE FOR DAY
01560 BUFFER   DEFS   20      ;TIME INFORMATION BUFFER
01570 ;
01580 ;      TABLE OF DAY MESSAGES
01590 ;
01600 SUM      DEFW   'SUN'
01610 MON      DEFW   'MON'
01620 TUE      DEFW   'TUE'
01630 WED      DEFW   'WED'
01640 THR      DEFW   'THR'
01650 FRI      DEFW   'FRI'
01660 SAT      DEFW   'SAT'
01670 ;
01680 ;      SUBROUTINE TO READ THE CLOCK'S COUNTERS
01690 ;
01700 GET      OUT      (C),B      ;SET UP ADDRESS FOR READ
01710          OUT      (C),B      ;DO AGAIN FOR TIME DELAY
01720          IN       A,(INPUT)   ;READ TIME
01730          ADD      A,30H      ;OBTAIN ASCII VALUE
01740          LD       (HL),A      ;PUT VALUE TO BUFFER
01750          INC      SI          ;INC TO NEXT BUFFER PTR
01760          DEC      B          ;DEC B FOR NEXT COUNTER
01770          RET
01780 ;
01790 ;      ROUTINE TO PUT SPACES BETWEEN TIME INFO
01800 ;
01810 FIL1      LD       (HL),20H   ;ASCII SPACE CODE
01820          INC      HL          ;INC NEXT SPACE
01830          LD       (HL),20H   ;PUT IN NEXT SPACE
01840          INC      HL          ;INC BUFFER PTR.
01850          RPT
01860 ;
01870          END      BEGIN

```

Program Listing 2. Burglar Alarm.

```

00010 ; BURGLAR ALARM PROGRAM
00020 ; WRITTEN BY DWAY ENGELHARDT 10/82
00030 ;
00040 ; MAY BE EXECUT'D WITH A /3M992...OR
00050 ; COMMAND 'ALARM', WITH USE OF -CNDTBL- PROGRAM.
00060 ;
00070 ORG 7910H
00080 BASIC EQU 1A19H      ;JUMP TO BASIC
00090 BURG EQU 7F09H      ;EXTERNAL IN CLK
00100 BURG1 EQU 7F0AB     ;EXTERNAL IN CLK
00110 BURG2 EQU 7F0BH     ;EXTERNAL IN CLK
00120 CLEAR EQU 1C9H      ;CLEAR SCREEN
00130 DORDLY EQU 12H      ;2 MIN TIME DELAY
00140 ENTOLY EQU 31       ;31 SEC ENT OLY (DOO VAL)
00150 SIREN EQU 12H       ;2 MIN SIREN ON TIME
00160 TOCLK EQU 7F9CH     ;EXTERNAL JUMP TO CLK
00170 ;*****
00180 ; START OF PROGRAM
00190 ;*****
00200 ALARM CALL CLEAR      ;CLS
00210 LD HL,MESS1
00220 CALL 21BH
00230 LD A,(ALSTAT)
00240 CP 0
00250 JR NZ,ALMACT
00260 LD HL,MESS2
00270 CALL 21BH
00280 JR AA
00290 ALMACT LD HL,MESS3
00300 CALL 21BH
00310 AA LD HL,MESS4
00320 CALL 21BH
00330 LD B,4
00340 CALL CODE
00350 CALL BUSON
00360 IN A,(1H)
00370 CFI
00380 AND 30H
00390 CP 0
00400 JR 2-ALT
00410 OUT (1B),A
00420 CALL DLY
00430 JB 2-ALT
00440 LD HL,ALMPLT
00450 CALL 21BH
00460 JR OFFA
00470 ALT LD A,(ALSTAT)
00480 CPL
00490 LD (ALSTAT),A
00500 CP 0
00510 JR NZ,ACTALM
00520 CALL CLEAR
00530 LD HL,MESS2
00540 CALL 21BH
00550 ;*****
00560 ; DISABLE ALARM PROGRAM
00570 ;*****
00580 OFFA XOR A
00590 ;CLR A

```

Listing 2 continued



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Listing 2 continued

```

00610 DI ;DISABLE INTERRUPTS
00620 LD (BURG).A ;CLEAR OUT JUMP
00630 LD (BURG1).A ; FROM CLK TO
00640 LD (BURG2).A ; ALARM PROGRAM
00650 LD (ALMPLG).A ;CLEAR SYSTEM FLAGS

00660 LD (BYPASS).A ;CLEAR TIME DELAY FLAGS
00670 LD (ALSTAT).A ;CLEAR SWAP FLAG
00680 EI ;ERABLE INTERRUPTS
00690 JP BASIC ;JUMP TO BASIC
00700 *****
00710 ; ENABLE ALARM PROGRAM
00720 *****
00730 ACTALM XOR A ;CLR A RFG
00740 LD (SHFCTR).A ;CLR FOR ALARM MESSAGES
00750 LD (MASK1).A ;CLR PORT 2 MASK
00760 LD (MASK2).A ;CLR PORT 3 MASK
00770 *****
00780 ; SCAN ALARMS FOR SELECTIVE DEACTIVATION
00790 *****
00800 UPDATE CALL SECT1 ;SET-UP FOR PORT 2 ALRMS
00810 CALL CHECK ;PRINT PORT 2 ALARMS
00820 CALL SECT2 ;SET-UP FOR PORT 3 ALRMS
00830 CALL CHECK ;PRINT PORT 3 ALARMS
00840 DI CALL 49H ;SCAN KEYBD
00850 CP 'R' ;RE-SCAN & DISPLAY ALARMS
00860 JR Z,ACTALM ;GO BACK AND RE-SCAN
00870 CP 'C' ;CONTINUE WITH PROGRAM
00880 JR NZ,D1 ;GO BACK TO KEYBD SCAN
00890 LD HL,MESS6 ;PRINT ALARMS DEACT NESS
00900 CALL 21BH ;PRINT ABOVE DEACT NESS
00910 LD A,5H ;SET FOR THLOOP
00920 THLOOP PUSH AP ;SAVE A CTR FOR TIME DLY
00930 CALL 6BH ;CALL TIME DELAY ROUTINE
00940 POP AF ;GET A BACK AND
00950 DEC A ; DEC LOOP CTR
00960 CP 0 ;IS A ZERO YET?
00970 JP NZ,THLOOP ;GO BACK IF NOT DONE
00980 CALL CLEAR ;CLS
00990 LD HL,MESS7 ;PRINT DO YOU WANT TIME
01000 CALL 21BH ; DELAY MESS?
01010 QTD CALL 49H ;QUESTION FOR TIME DELAY
01020 CP 'Y' ; IF NO -- CONTINUE
01030 JR Z,DLYARM ;DO TIME DELAY
01040 CP 'N' ;CONTINUE IF NO
01050 JR NZ,QTD ;RE-SCAN KEYBD
01060 ARH LD HL,BYPASS ;GET TIME DLY CONTRL BYTF
01070 SET 0,(HL) ;SET TO BYPASS ENTR DELAY
01080 JR ARMIT ;SKIP TIME DELAY SETUP
01090 DLYARM LD HL,BYPASS ;GET TIME DLY CONTRL BYTF
01100 SET 1,(HL) ;SET FOR ENTRANCE DELAY
01110 LD HL,TIMER ;GET EXIT DELAY VALUE
01120 LD (HL),DORDLY ;2 MIN DOOR EXIT DELAY
01130 ; AND 38 SEC ENTR DELAY
01140 *****
01150 ; PATCH ALARM PROGRAM TO CLK
01160 *****
01170 ARMIT LD A,0C3H ;PATCH JUMP INSTR TO CLK
01180 DI ;DISABLE INTERRUPTS
01190 LD (BURG).A ;1ST PART OF JUMP INSTR.
01200 LD HL,CONNECT ;GET JUMP ADDRESS IN ALRM
01210 LD (BURG1),HL ;LOAD TO CLK ALARM JUMP
01220 XOR A ;A R M T R E
01230 LD (ALMPLG).A ; B U R G L E R S Y S
01240 CALL BUSON ;TURN ON INTERNAL BUS
01250 IN A,(2H) ;GET AND STORE
01260 LD (MASK1),A ; PORT 2 MASK
01270 IN A,(3H) ;GET AND STORE
01280 LD (MASK2),A ; PORT 3 MASK
01290 CALL BUSOFF ;TURN OFF INTERNAL BUS
01300 CALL CLEAR ;CLR SCREEN
01310 LD HL,MESS3 ;PRINT SYSTEM
01320 CALL 21BH ; ACTIVATED MESSAGE
01330 EI ;ENABLE INTERRUPTS
01340 JP BASIC ;JUMP TO BASIC
01350 *****
01360 ; SECTION SCANNED BY CLK ONCE A SECOND
01370 *****
01380 CONNECT LD HL,3C3FH ;GET SCREEN LOC FOR 'A'
01390 LD A,(SNITCH) ;GET SNAP CONTROL BYTF
01400 CPL ;COMPLEMENT VALUE
01410 LD (SWITCH),A ;STORE VALUE BACK
01420 CP 0 ;IS IT ZERO?
01430 JR Z,ASTRIM ;SKIP IF ZERO
01440 LD (HL),'' ;PUT BLANK TO SCREEN
01450 JR ASTRIX+2 ;SKIP
01460 ASTRIX LD (HL),'' ;PUT 'A' TO SCREEN
01470 LD HL,BYPASS ;GET TIME DELAY BYTF
01480 BIT 1,(HL) ;IS IT SET FOR DELAY?
01490 JP NZ,THEOUT ;GO TO COUNTDOWN ROUTINE
01500 LD HL,ALMPLG ;GET ALARM CONTROL WORD
01510 BIT 5,(HL) ;SET FOR SIREN?
01520 JR NZ,THEOUT ;DO 38 SEC OFF INTVRAL
01530 BIT 6,(HL) ;IS MAIN SIREN ON?
01540 JR NZ,CNTOWN ;GO AND COUNT DWN ON TIME
01550 BIT 4,(HL) ;SET TO ALTERNATE SONA
01560 JR NZ,T30SEC ;BEEP SONA FOR 38 SEC
01570 BIT 3,(HL) ;SET TO BYPASS ALARM SCAN
01580 JR NZ,SKIP ; UNTIL SIREN CYCLE DONE
01590 CALL ACTSCN ;SCAN PORT 2 FOR ALARMS
01600 CALL CHECK ;ARE THERE ANY ALARMS?
01610 CALL SECT2 ;SCAN PORT 3 FOR ALARMS
01620 CALL CNECK ;ARE THERE ANY ALARMS?
01630 LD HL,ALMPLG ;GET ALARM CONTROL BYTF

```

Listing 2 continued

```

01640      BIT      3,(HL)      ;WILL BE SET ON ALARM COND
01650      JF       2,TOCLK     ;JUMP BACK TO CLK
01660      SETIP   BIT      7,(HL)
01670      JR       NZ,T3SEC    ;IS ENTRANCE TIME OLY SET
01680      NODLAY   CALL    BUSON ;DONT TURN ON SIREN YET
01690      LD       A,16        ;TURN ON INTERNAL BUS
01700      OUT      (1R),A      ;VALUE FOR SIREN
01710      CALL    BUSOFF      ;TURN ON SIREN
01720      LD       HL,ALMFLG   ;SHUT OFF INTERNAL BUS
01730      SET      6,(HL)     ;GET ALARM CONTROL BYTE
01740      LD       HL,TIMER    ;SET TO FLAG SIREN ON TIME
01750      LD       (HL),SIREN ;GET TIME CONTROL WORD
01760      JR       CNTDWN      ;LOAD SIREN WAILING TIME
01770      LD       HL,TIMER    ;GO AND DEC TIME UNTIL=0
01780      KOR      A           ;GET TIME CONTROL WORD
01790      DEC      (HL)        ;CLR A FOR COMPARE
01800      CP       (HL)        ;DEC ENTRANCE DLY 30 SEC
01810      JR       2,NODLAY    ;TEST HL FOR ZERO
01820      LD       HL,ALMFLG   ;TIME DONE-TURN ON SIREN
01830      SET      4,(HL)     ;GET CONTROL BYTE
01840      BIT      1,(HL)     ;SET TO TURN ON SONA
01850      JR       NZ,SNAP     ;BIT USED TO SWITCH
01860      SET      1,(HL)     ;SONA (ON-OFF) TO ALERT
01870      JR       OUTSON      ;USER TO SHUT SYSTEM
01880      RES      1,(HL)     ;OFF UPON ENTRY
01890      CALL    BUSON      ;RESET ALT FLAG
01900      LD       A,32        ;TURN ON INTERNAL BUS
01910      OUT      (1R),A      ;VALUE TO TURN ON SONA
01920      CALL    BUSOFF      ;TURN ON OR OFF SONA
01930      JF       TOCLK       ;TURN OFF INTERNAL BUS
01940      LD       HL,TIMER    ;JUMP TO CLK PROGRAM
01950      KOR      A           ;COUNTDOWN SECTION TIMER
01960      DEC      (HL)        ;CLR A FOR COMPARE
01970      CP       (HL)        ;DEC TIME DELAY
01980      JF       NZ,TOCLK    ;TEST FOR ZERO
01990      CALL    BUSON      ;SKIP IF NOT ZERO TO CLK
02000      LD       A,16        ;TURN ON INTERNAL BUS
02010      OUT      (1R),A      ;TURN OFF SIREN
02020      CALL    BUSOFF      ;TURN OFF INTERNAL BUS
02030      LD       HL,ALMFLG   ;SET-UP FOR OFF INTERVAL
02040      SET      5,(HL)     ;SET FOR SIREN OFF TIME
02050      LD       HL,TIMER    ;GET TIMER CONTROL WORD
02060      LD       (HL),ENTDLY ;31 SEC PAUSE BWTN CYCLE
02070      LD       HL,TIMER    ;PAUSE INTERVAL ROUTINE
02080      KOR      A           ;CLR A FOR ZERO COMPARE
02090      DEC      (HL)        ;DEC TIME
02100      CP       (HL)        ;TEST FOR ZERO
02110      JF       NZ,TOCLK    ;GO IF TIME LEFT
02120      KOR      A           ;CLR A
02130      LD       (ALMFLG),A ;CLR CONTROL WORD
02140      LD       HL,BYPASS   ;AND GO FOR NEW CYCLE
02150      RES      1,(HL)     ;DISABLE ENTRANCE DELAY
02160      JF       TOCLK       ;RETURN TO CLK PROGRAM

02170      ;*****
02180      ; ALARM SCAN SECTION
02190      ;*****
02200      SECT1   CALL    CLEAR ;CLR SCREEN
02210      LD       HL,MESS5     ;PRINT ALARM STATUS MESS
02220      CALL    21BH          ;GET MASK FOR ALARMS THAT
02230      LD       A,(MASK1)    ;HAVE BEEN DEACTIVATED
02240      LD       B,A           ;TURN ON INTERNAL BUS
02250      CALL    BUSON          ;READ PORT 2 FOR ALARMS
02260      IN       A,(2H)        ;TURN OFF INTERNAL BUS
02270      CALL    BUSOFF        ;GET START OF PORT 2 MESS
02280      LD       HL,MTBLE1    ;TBLE & SAVE LOCATION
02290      LD       (MTBLE),HL
02300      RET
02310      SECT2   LD       A,(MASK2) ;GET MASK FOR ALARMS THAT
02320      LD       B,A           ;HAVE BEEN DEACTIVATED
02330      CALL    BUSON          ;TURN ON INTERNAL BUS
02340      IN       A,(3H)        ;READ PORT 3 FOR ALARMS
02350      CALL    BUSOFF        ;TURN OFF INTERNAL BUS
02360      LD       HL,MTBLE2    ;GET START OF PORT 3 MESS
02370      LD       (MTBLE),HL
02380      RET
02390      CHECK   XOR      B      ;MASK OUT DEACT. ALARMS
02400      JR       Z,RETURN      ;ZERO MEANS NO ALARMS
02410      LD       HL,ALMFLG     ;GET ALARM CONTROL WORD
02420      SET      3,(HL)       ;SET TO BYPASS SECT CALLS
02430      CP       1            ;ALARM AT FRONT DOOR?
02440      JR       Z,EE         ;ZERO - IS YES THERE IS
02450      CP       2            ;ALARM AT GARAGE-BSE ENT?
02460      JR       Z,DD         ;ZERO - IS YES THERE IS
02470      LD       HL,BYPASS    ;GET TIME DLY COMTL BYTE
02480      BIT      0,(HL)       ;IS 30 SEC TIME DLY SET?
02490      JR       NZ,DD        ;SKIP IF YES
02500      PUSH    AF            ;SAVE ALARM BITS
02510      LD       HL,ALMFLG     ;GET ALARM CONTROL BYTE
02520      SET      7,(HL)       ;SET FOR ENTR DLY 30 SEC
02530      LD       A,ENTDLY     ;LOAD ENTRANCE DELAY TIME
02540      LD       (TIMER),A    ;TO TIME CONTROL BYTE
02550      POP     AF            ;RESTORE ALARM BITS
02560      LD       B,A          ;HAVE BIT PATTERN
02570      LD       D,B          ;CLR D REGISTER
02580      BIT      0,B           ;IS BIT 0 SET FOR ALARM?
02590      JR       Z,SHIFT      ;SKIP IF NOT AND TEST AGN
02600      LD       HL,(MTBLE)    ;GET CURRENT TABLE ADDRES
02610      LD       A,(SHFCTR)   ;GET MESSAGE CTR OR INDEX
02620      LD       E,A          ;STORE INDEX INTO E
02630      ADD     HL,DE          ;GET APPROPRIATE MESS
02640      LD       E,(HL)        ;GET LSB LOCATION OF MESS
02650      INC     HL            ;INC PTR TO MSB LOCATION
02660      LD       D,(HL)        ;GET MSB LOCATION OF MESS
02670      EX      DE,HL         ;PUT MESS LOCATION TO HL

```

Listing 2 continued

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```

02680 CALL 21BH ;PRINT ALARM MESSAGE
02690 SHIFT LD A,(SHFCTR) ;GET MESSAGE CTR AND INC
02700 ADD A,2 ; CTR FOR NEXT MESS LOC
02710 CP 16 ;ALL 8 MESS BEEN PRNTD?
02720 JR Z,PRFTRN ;RETURN IF YES
02730 LD (SHFCTR),A ;SAVE NEW INDEX 4
02740 RR B ;SHIFT 5 RIGHT 1 BIT
02750 JR C1 ;GO TEST NEW BIT FOR ALRM
02760 PRFTRN XOR A ;PORT HAS BEEN SCANNED
02770 LD (SHFCTR),A ;CLR FOR NEXT PORT CHECK
02780 RETURN RET ;RETURN FROM CALL
02790 ;*****
02800 ; SECRFT CODE ROUTINE TO ACT. OR DEACT ALARM PROGRAM
02810 ; CODE = MOM
02820 ;*****
02830 CODE DEC 3 ;DEC CTR AND TEST FOR
02840 LD A,B ; ONLY THREE TRIES TO
02850 CP 0 ; GET CODE CORRECT
02860 JR Z,BAIL ;CODE ERROR...EXIT PROG
02870 CALL 49H ;SCAN KEYBD FOR CODE
02880 CP 'M' ;IS FIRST CHARCT. A 'M'
02890 JR NZ,CODE ;RE-SCAN KEYBD IF NOT
02900 CALL 49H ;SCAN KEYBD
02910 CP 'O' ;IS 2ND CHARCT. A 'O'
02920 JR NZ,CODE ;RE-SCAN KEYBD IF NOT
02930 CALL 49H ;SCAN KEYBD
02940 CP 'M' ;IS LAST CHARCT. A 'M'
02950 JR NZ,CODE ;DEC 3 RRG AND BAIL OUT
02960 RET
02970 ;*****
02980 ; ROUTINE TO PRINT CODE ERROR & JUMP TO BASIC
02990 ;*****
03000 BAIL CALL CLEAR ;CLB SCREEN
03010 LD HV,ERROR
03020 CALL 21BH ;PRINT CODE ERROR MESS
03030 JP BASIC ;JUMP TO BASIC
03040 ;*****
03050 ; ROUTINE TO TURN INTERNAL BUS ON
03060 ;*****
03070 BUSON PUSH AF ;SAVE A REG AND FLAGS
03080 LD A,16
03090 OUT (0ECH),A ;ENABLE INTERNAL BUS
03100 POP AF ;RESTORE A REG AND FLAGS
03110 RET
03120 ;*****
03130 ; ROUTINE TO TURN INTERNAL BUS OFF
03140 ;*****
03150 BUSOFF PUSH AF ;SAVE A REG AND FLAGS
03160 XOR A
03170 OUT (0ECH),A ;TURN OFF INTERNAL BUS
03180 POP AF ;RESTORE A REG AND FLAGS
03190 RET
03200 ;*****
03210 ; TIME DELAY USED TO ALLOW RELAYS TIME TO SWITCH
03220 ;*****
03230 DLY LD BC,4FFFH ;VALUE USED FOR CNT DWN
03240 CALL 60H ;CALL TIME DLY
03250 IN A,(1H) ;READ RELAYS
03260 CPL ;COMPLEMENT VALUE
03270 AND 30H ;MASK FOR ALARM RELAYS
03280 CP 0 ;ARE THEY OFF?
03290 RET
03300 ;*****
03310 ; VARIABLES
03320 ;*****
03330 ALMFLG DEFB 0 ;ALARM SYSTEM CONTRL BYTE
03340 ALSTAT DEFB 0 ;BURGLER ALARM STATUS
03350 BYPASS DEFB 0 ;TIME DELAY CONTROL BYTE
03360 MASK1 DEFB 0 ;SAVES PORT 2 DEACT ALRMS
03370 MASK2 DEFB 0 ;SAVES PORT 3 DEACT ALRMS
03380 MTBLE DEFW 0 ;TABLE INDEX PTR.
03390 SHFCTR DEFB 0 ;USED FOR MESS TBL INDEX
03400 SWITCH DEFB 0 ;USED TO BLINK '*'
03410 TIMER DEFB 0 ;TIME DELAY CONTROL WORD
03420 ;*****
03430 ; MAIN MESSAGE TABLE
03440 ;*****
03450 MESS1 DEFM 'THIS IS THE BURGLER ALARM PROGRAM'
03460 DEFW 0D0AH
03470 MESS2 DEFM 'THE ALARM SYSTEM IS * DEACTIVATED *'
03480 DEFW 0DH
03490 MESS3 DEFM 'THE ALARM SYSTEM IS ** ACTIVATED **'
03500 DEFW 0DH
03510 MESS4 DEFM 'ENTER (CODE WORD) TO PUT SYSTEM IN '
03520 DEFW 'OPPOSITE STATE'
03530 DEFW 0A0AH
03540 DEFM ' ** OFF-ON OR ON-OFF**'
03550 DEFW 0DH
03560 MESS5 DEFW 0AH
03570 DEFM 'THESE ITEMS ARE IN ALARM CONDITION '
03580 DEFW 'CLOSE NEEDED POINTS'
03590 DEFW 0AH
03600 DEFM 'R = TO RECHECK C = CONTINUE PROGRAM'
03610 DEFW 0DH
03620 MESS6 DEFM '**** TAKE NOTE --ITEMS ABOVE ARE DE-'
03630 DEFW 'ACTIVATED ****'
03640 DEFW 0DH
03650 MESS7 DEFW 0AH
03660 DEFM 'DO YOU NEED TIME DELAYS OF *2 MINUTES '
03670 DEFW 'LEAVING AND 30 SECONDS '
03680 DEFW 'ENTERING* ON THE ENTRANCE DOORS? Y/N'
03690 DEFW 0DH
03700 ERROR DEFW 0AH
03710 DEFM '---CODE WORD---ENTRY ERROR..PROGRAM '
03720 DEFW 'EXITED!'
03730 DEFW 0DH
03740 ALMFLT DEFM 'RELAY FAULT---SIRFN OR SONA ILLEGALLY ON'

```

Listing 2 continued

zone and time entries. When it completes this mode, the program patches the Auto mode back in for a continued time scan. The Exit command leaves the program and jumps back to Basic.

This program also checks for relay failures and uses Port 4, bit 2 to sound a buzzer if a failure occurs. Upon entry to the program, it indicates the status of the system and the zone that is currently running if applicable. It displays a message giving you the option to deactivate the system or exit back to Basic. There is a 1½-minute delay between each zone that allows time for water pressure to stabilize.

CMDTABL Program

Program Listing 4 lets you patch custom commands to the Basic command table. Presently, I include only two commands—Sprink and Alarm. When you enter either of these two commands under Basic, the specified program runs. If you add more commands to the table, insert them in order but keep them between the ENDTBL label. This label automatically computes the length of the command table for scanning purposes.

Execute this program with a /29024. The set-up section patches the main body of this program to the Basic command table. Upon execution, two more commands are added to the system. This program runs anywhere in memory by changing the ORG statement.

Conclusion

You should now have a Port I/O board with relays to control the real world, and hopefully an understanding of how to control the port board and its functions. You should have enough information to expand in regard to port I/O control. The sprinkler and burglar alarm systems provide a couple of good applications to real-world control.

The amount of control applications available are virtually unlimited. CMDTBL opens a door to custom users for designing your own Basic commands and applications. You should learn a lot about your Model III and computers in general by putting together this system, as interfacing and controlling real world applications involve many aspects of your micro.

For a 16K System

As shown, the burglar alarm and sprinkler system don't assemble on a 16K RAM system since they include so many comments and banners. I made

Listing 2 continued

```

03750 DEF0 0DH
03760 ;*****
03770 ; PORT 2 ALARM MESSAGE TABLE
03780 ;*****
03790 MTBLE1 DEF0 A0 ;GIVES LOC FOR PORT 2
03800 DEF0 A1 ; ALARM MESSAGES
03810 DEF0 A2
03820 DEF0 A3
03830 DEF0 A4
03840 DEF0 A5
03850 DEF0 A6
03860 DEF0 A7
03870 ;*****
03880 ; PORT 3 ALARM MESSAGE TABLE
03890 ;*****
03900 MTBLE2 DEF0 B0 ;GIVES LOC FOR PORT 3
03910 DEF0 B1 ; ALARM MESSAGES
03920 DEF0 B2
03930 DEF0 B3
03940 DEF0 B4
03950 DEF0 B5
03960 DEF0 B6
03970 DEF0 B7
03980 ;*****
03990 ; PORT 2 ALARM MESSAGES
04000 ;*****
04010 A0 DEF0 'FRONT DOOR' ;** NOTE **.. A0
04020 DEF0 0DH ; AND A1 MUST BE
04030 A1 DEF0 'GARAGE DOOR' ; USED AS ENTR
04040 DEF0 0DH ; DLY INPUTS
04050 A2 DEF0 'FAMILY ROOM'
04060 DEF0 0DH
04070 A3 DEF0 'SLIDING DOORS'
04080 DEF0 0DH
04090 A4 DEF0 'KITCHEN WINDOW'
04100 DEF0 0DH
04110 A5 DEF0 'DINING OR LIVING ROOM WINDOW'
04120 DEF0 0DH
04130 A6 DEF0 'SEWING ROOM'
04140 DEF0 0DH
04150 A7 DEF0 'A BATHROOM WINDOW'
04160 DEF0 0DH
04170 B0 DEF0 'MASTER BEDROOM'
04180 DEF0 0DH
04190 B1 DEF0 'BEDROOM #1 WINDOW'
04200 DEF0 0DH
04210 B2 DEF0 'BEDROOM #2 WINDOW'
04220 DEF0 0DH
04230 B3 DEF0 'BASEMENT WINDOW'
04240 DEF0 0DH
04250 B4 DEF0 'CAR #1 GARAGE DOOR' ;NOTE: I HAVE TWO
04260 DEF0 0DH
04270 B5 DEF0 'CAR #2 GARAGE DOOR'
04280 DEF0 0DH
04290 B6 DEF0 'WATER LEAK IN BASEMENT';SENSE LEAKS
04300 DEF0 0DH
04310 B7 DEF0 'PANIC BUTTON' ;FOR EMERGENCY
04320 DEF0 0DH
04330 END ALARM

```

the listings easy to follow so you can assemble them on a 16K RAM system without the comments and banners. ■

Contact David L. Engelhardt at 10221 W. 101 St. Place, Broomfield, CO 80020.

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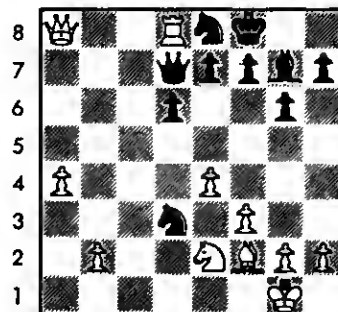
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3. d2-d4	c5-d4	19. e3-f2	b5-b4
4. f1-b5+	c8-d7	20. c2-b3	a6-a5
5. b5-d7+	d8-d7	21. d1-d4!	b7-b5
6. f3-d4	g8-f6	22. c3-b4	a5-b4
7. b1-c3	g7-g6	23. a1-c1!	c4-b6
8. a1-g1	f8-g7	24. c1-c8+	b6-c8
9. c1-e3	a8-g8	25. b3-c4	b5-d7
10. d1-d3	a7-a8	26. c4-b4	c8-a7
11. c3-d5	b7-b5?	27. b4-b8+	f6-e8
12. d5-b6	d7-b7	28. d4-c4	a7-c6
13. b6-a8	b7-a8	29. b8-a8	c6-e5
14. f2-f3	b8-d7	30. c4-c8	g8-f8
15. f1-d1	f8-c8	31. a2-a4	e5-d3
16. c2-c3	a8-b7	32. c8-d8!	resigns



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From the January 1981 issue of the CSRA Computer Club newsletter

There was some amusement at the November meeting when the Radio Shack representatives stated that the software in the ROM cartridges could not be copied. This month's 68 Micro Journal reported they had disassembled the programs on ROM by covering some of the connector pins with tape. They promise details next month. Never tell a hobbyist something can't be done! This magazine seems to be the only source so far of technical information on the TRS-80 color computer. Devoted to SS-50 6800 and 6809 machines up to now, 68 Micro Journal plans to include the TRS-80 6809 unit in future issues.

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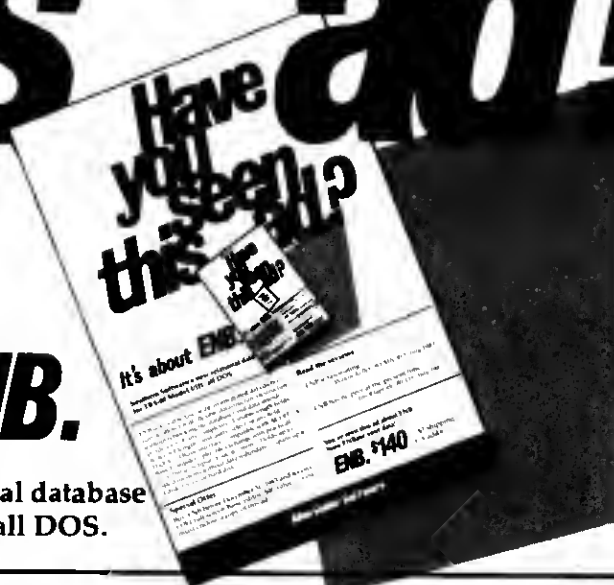
160 • 80 Micro, December 1983

Letter 3 continued on p. 164

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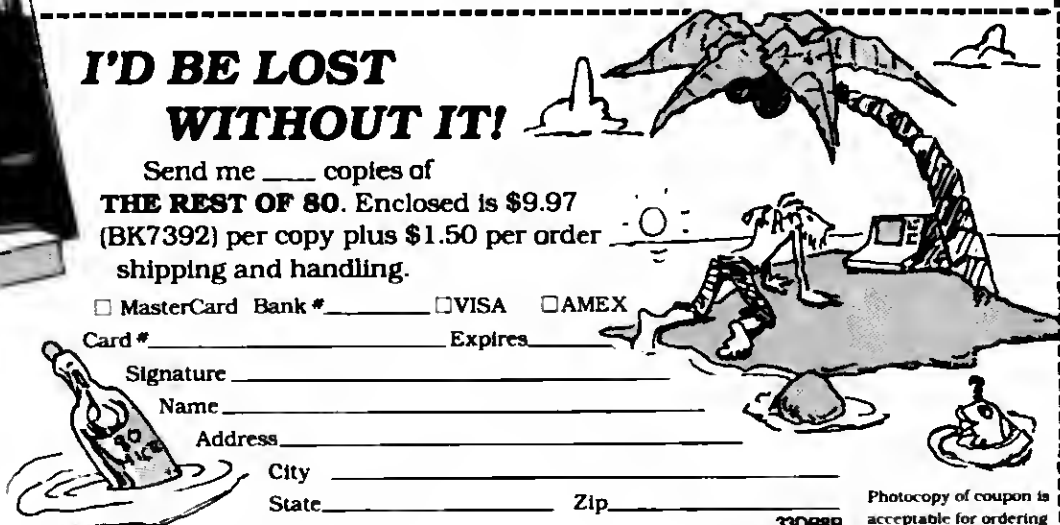
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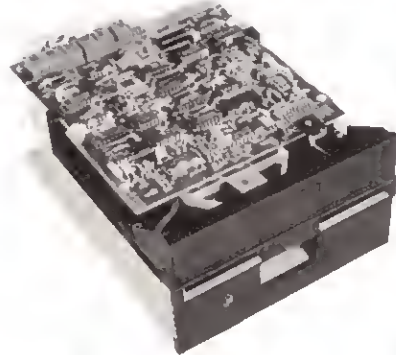
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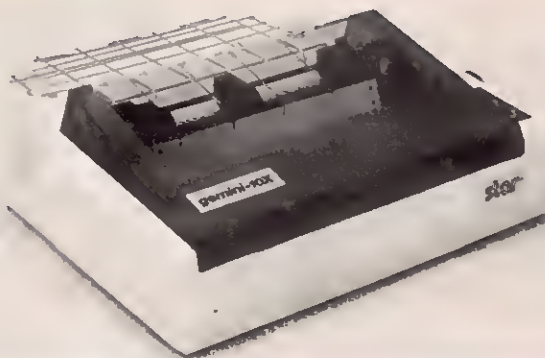
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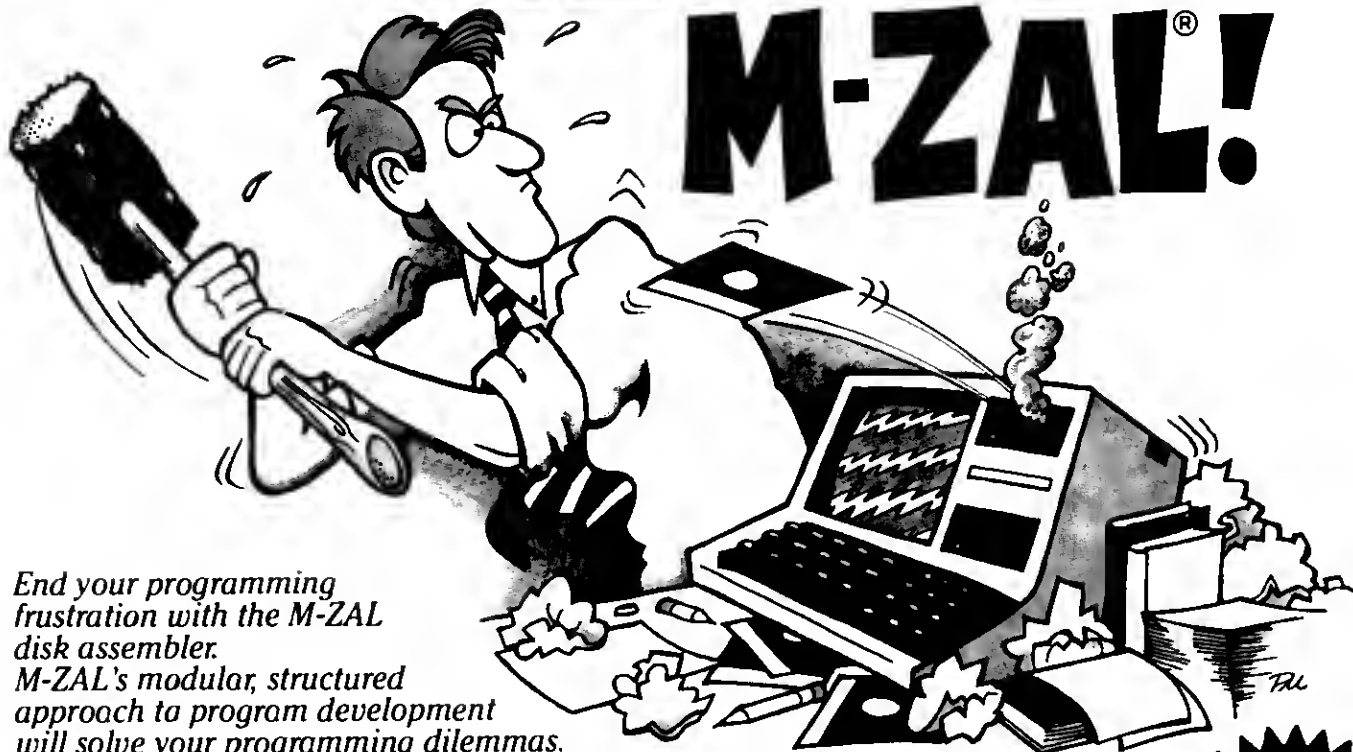
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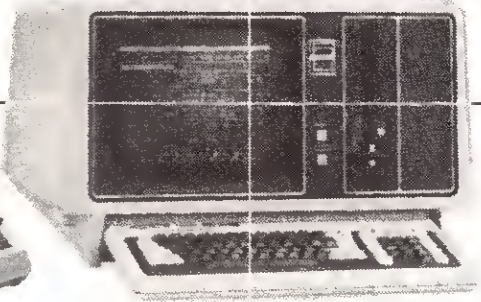
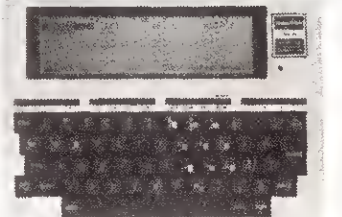
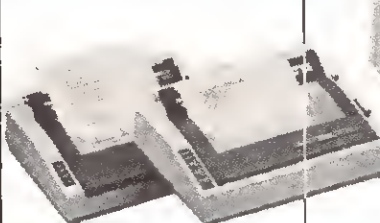
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Chameleon Code

by Bradley Murray

The mixture of Basic programs with Assembly-code subroutines is powerful, taking advantage of the simplicity of one and the speed of the other.

Sometimes the Assembly-code routines are loaded in Basic; other times it is better to POKE the decimal equivalents of the routine's object code into memory. It is a nuisance, though, to convert the object code to decimal, check the values and type the data lines.

I wrote a program that interprets an object file produced by an editor/assembler, converts the object code to decimal values, and writes these values to an ASCII file of data lines. These are later merged into the Basic program that POKEs the values into memory.

The program gives the starting and ending POKE locations, the memory size required to protect the POKEd program, and the hexadecimal (hex) address needed for a DEFUSRn = statement.

How It Works

Program Listing 1 requests the name of the file to be converted, the name of the ASCII data file (the output file), the starting line number of the data file, and the line number increment.

The program is listed one statement per line to increase its intelligibility, but when entering the program ignore all comment lines and compress statements into single lines. The following line numbers are branch points—you must preserve 1100, 1260, 1360, 1630, 1800, 1870, 1940, 2000, 2090, and 2240.

The program begins with an error trap: The object file first opens as an I-file, closes and then reopens as an R-file. If the file does not exist, a random file with no data is created and read, giving unpredictable, incorrect output. If the file is first opened as "I", the file-not-found error can be trapped.

Tired of converting Assembly code into Basic data statements by hand? This speeds it up.

Reading the file as an Input (I) file, with an INPUT #2, AS would be simpler, but has one problem. A byte containing 00, valid in the object code, would be bypassed. The code D0A7 00FF would be incorrectly read into the string as D0A7FF. This does not happen when the File is read with a GET1,r (see line 1240).

Line 1090 sets HX\$ to contain all the hex codes, from which values will be extracted in line 2070 to make a decimal-to-hex conversion.

Line 1180 fields the input file buffer as two variables of 128 bytes each. No single string variable can contain the full 256 bytes. If your older version of Basic has not been modified, the second half of the buffer field contains only 127 bytes. This leads to problems if your object program occupies a full disk sector or more (256 bytes).

The first byte of an editor/assembler object file is either 01 (if created by the EDTASM in the NEWDOS package), or 05 (if created by Radio Shack's Editor/Assembler). In either case the first byte of interest to this program contains 01—the command to load.

Line 1260 extracts a byte from the string AS(1). The first time through, it extracts the first byte and converts it to decimal. If it is not 01, the second byte

will contain a certain number of bytes to be bypassed before loading program code. Line 1310 increases the pointer by this amount, to skip over the required bytes. If the following byte is 01, it's a loading instruction.

The byte following the loading instruction gives the number of bytes to be loaded, including 2 extra bytes containing the loading address. Lines 1380-1390 decode the number of program bytes NB to be extracted from the string. Zero is interpreted as 256, and 2 is subtracted from NB to take care of the loading-address bytes.

The loading address is used to calculate the first location into which Basic will POKE the program, as well as the memory size needed to protect the program.

Line 1400 moves the pointer to the least significant bit (LSB) of the loading address and blanks the hex value string (ST\$) for this address. The program calls subroutine 2000 to get the decimal value of the byte, find the quotient and remainder (modulo-16), and convert each to one of the hex characters in HX\$. Upon return, it assigns ST the decimal value of LSB.

The pointer moves to the next byte, the most-significant bit (MSB) of the starting address. With a call to 2000, this is converted to decimal and to hex. The hex code is put before the LSB and linked with it to give the starting address in hex (ST\$).

The Key Box

Model I
32K RAM
Disk Basic
Editor/Assembler

IF YOU'RE GOING TO BE PICKY ABOUT AN OPERATING SYSTEM SEE WHICH WAS PICKED BEST.



The readers of 80 Micro were asked to select their favorite operating system for the TRS-80 Model I&III. LDOS, DOSPLUS, TRSDOS, MULTIDOS, WOBOS I and NEWDOS/80 were all on the ballot. They picked NEWDOS/80.

The editors of 80 Micro have also awarded their Hall of Fame Awards. From among every software package on the market, the editors picked only six that they felt made a lasting and significant contribution to the TRS-80 computer. NEWDOS/80 was one of the six.

Since we first introduced the NEWDOS operating system we've been stating its features, capabilities and advantages. Thank you 80 Micro readers and NEWDOS/80 users for supporting us.

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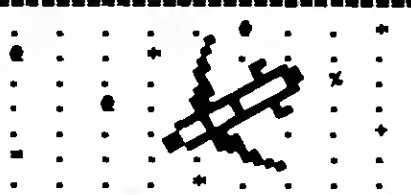
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Upon return from line 2000, the program multiplies the decimal value of this byte by 256 and adds it to the LSB to give the starting address in decimal (ST). If the decimal value is greater than 32767, line 1520 sets the sign bit so the location to POKE will be negative. Line 1510 saves the positive value in MM as the memory size value. EN in line 1570 is the ending POKE address.

N points to the byte within the string AS(K). The subscript K is either 1 or 2; each record is split into two sub-records (see line 1180). K starts with a value of 1 in line 1620, increased when 128 bytes are decoded (lines 1730-1740). If K equals 3, 256 bytes have been decoded and the next record is read from the disk (1770-1780).

NB is the number of program bytes to be converted to decimal and put on the data line. KB is the number of bytes actually converted and added. Line 1800 compares NB and KB.

NN keeps track of the number of values on a single data line. As long as this value does not exceed 14, a comma is appended to the data line 1850. When there are 14 items, the routine writes a carriage return/line feed to the file (CHR\$(13)), increases the line number, and generates a new data line (lines 1870-1890).

The decimal value of the code is not written directly to the data line, since spaces appear before and after the number. Lines 1630-1670 convert it to string format, trim it, and write it as a string. When line 1800 determines that the

number of bytes decoded and written (KB) equals the number of bytes required (NB), the program calls subroutine 2090, the ending routine. If the next byte is 01, more program bytes must be added to the data. NB is calculated as before, but the loading address is not needed.

If the next byte is not 01, the entire program has been loaded. Ordinarily this byte and the next would be 0202, followed by the program entry address (not always the loading address). In this conversion I assumed the starting address and the loading address were the same. If not, adjust them with a JP or JR to the starting address.

You can modify the program to handle a different starting address. If the next byte is not 01 (line 2180), check whether it and the next byte have a value of 02. If so, the 2 bytes following 0202 contain the entry address. Convert ST\$ to this, using the technique above. ST (the start of loading) and MM (the memory size) remain unchanged.

If the byte is not 01 the loading is finished. The program branches to produce the hex value used for the address of a USRn call, the starting and ending loop index values for the POKE, and the memory size used in Basic when running the program.

Program Listing 2 POKes the Assembly-code routine into memory and runs it. ■

Contact Bradley Murray, S.J., at
Loyola College, Baltimore, MD 21210.

Program Listing 1. The Converter program.

```

1000 *      ** CONVERTER PROGRAM **
1010
1020 CONVERTS AN OBJECT CODE FILE
1030 TO "DATA" LINES SUITABLE FOR
1040 BASIC "POKE" FUNCTION
1050
1060 TRAP FILE-NOT-FOUND ERROR
1070 ON ERROR GOTO 1940
1080 DIM AS(2)
1090 HXS="0123456789ABCDEF"
1100 LINEINPUT "OBJECT CODE FILESPEC: ";FS
1110 OPEN "I" TO SEE IF FILE EXISTS
1120 OPEN "I",FS
1130 CLOSE I
1140 IF SO, OPEN AS A RANDOM FILE
1150 OPEN "R",FS
1160 BE SURE YOU HAVE UPDATED VERSION OF
1170 OF BASIC. IF NOT: 127 AS AS(2)
1180 FIELD#1,128 AS AS(1),128 AS AS(2)
1190 LINEINPUT "ASCII DATA FILESPEC: ";FS
1200 OPEN "O",FS
1210 INPUT "ASCII DATA FILE STARTING LINE NUMBER ";LN
1220 INPUT "LINE NUMBER INCREMENT";IN
1230 PRINT #2,LN;"DATA "
1240 GET I,1
1250 N=1
1260 C=ASC(MID$(AS(1),N,1))
1270 C = LOAD COMMAND? (01H)
1280 IF NOT, NEXT BYTE IS NUMBER OF BYTES
1290 TO SKIP OVER.
1300 IF C=1 THEN 1360
    ELSE N=ASC(MID$(AS(1),N+1,1))
1310 N=N+3
1320 CHECK WHETHER THIS BYTE IS 01H
1330 GOTO 1260
1340 YES: NEXT BYTE GIVES NUMBER OF BYTES TO
1350 LOAD, INCLUDING A TWO-BYTE LOADING ADDR
1360 N=N+1
1370 NB = NUMBER OF PROGRAM BYTES TO LOAD
1380 NB=ASC(MID$(AS(1),N,1))

```

Listing 1 continued

```

1390 IF NB=0 THEN NB=254
      ELSE NB=NB-2
1400 N=N+1
1410 '      ST$ = STRING FOR HEX CODE OF LOADING ADDR
1420 ST$=""
1430 GOSUB 2000
1440 '      ST WILL BE LSB OF STARTING ADDRESS
1450 ST=X
1460 N=N+1
1470 GOSUB 2000
1480 '      ST WILL BE DECIMAL VALUE OF STARTING ADDR
1490 ST=ST+K*256
1500 '      SAVE ST IN MM (MEMORY SIZE)
1510 MM=ST
1520 IF ST>32767 THEN ST=ST-65536
1530 '      EN = ENDING ADDRESS
1540 '      KB=NUMBER OF PROGRAM BYTES READ FOR THIS
1550 '      SERIES OF LOADS (UP TO NEXT $1 CODE)
1560 '      N=BYTE BEING DECODED IN AS(K)
1570 EN=ST-1
1580 KB=0
1590 N=N+1
1600 '      NN = NUMBER OF VALUES ON A "DATA" LINE
1610 NN=0
1620 K=1
1630 C=ASC(MID$(AS(K),N,1))
1640 CS=STR$(C)
1650 '      REMOVE LEADING BLANK FROM NUMBER
1660 CS=RIGHT$(CS,LEN(CS)-1)
1670 PRINT #2,CS;
1680 N=N+1
1690 KB=KB+1
1700 EN=EN+1
1710 '      HAVE 128 BYTES BEEN READ? IF SO
1720 '      START ON 2ND 128 BYTES OF RECORD
1730 IF N<129 THEN 1800
      ELSE N=1
1740 K=K+1
1750 '      IF 2ND 128 BYTES HAVE BEEN READ,
1760 '      GET NEXT RECORD
1770 IF K=2 THEN 1800
      ELSE GET 1
1780 K=1
1790 '      HAVE ALL BYTES BEEN READ?
1800 IF KB=NB THEN GOSUB 2000
1810 NN=NN+1
1820 '      ARE THERE 14 NUMBER ON "DATA" LINE?
1830 '      IF SO, START A NEW LINE; IF NOT,
1840 '      ADD " "
1850 IF NN=14 THEN 1870
      ELSE PRINT #2," ";
1860 GOTO 1830
1870 NN=0
1880 LN=LN+1
1890 PRINT #2,CHR$(13);LN;"DATA ";
1900 GOTO 1830
1910 '-----
1920 '      ERROR: OBJECT FILE NOT FOUND
1930 '
1940 IF ERR<>186 THEN ON ERROR GOTO 0
1950 CLS : PRINT"FILE NOT FOUND"
1960 RESUME 1100
1970 CLOSE
1980 '-----
1990 '      CONVERT 2-BYTE NUMBER TO HEX
2000 '
2010 '      GET DECIMAL VALUE FROM STRING
2020 K=ASC(MID$(AS(1),N,1))
2030 '      QUOTIENT & REMAINDER, MOD-16
2040 Q=INT(K/16)
2050 R=K-Q*16
2060 '      SELECT HEX VALUE FROM STRING HEX$
2070 ST$=MID$(HEX$,Q+1,1)+MID$(HEX$,R+1,1)+ST$
2080 RETURN
2090 '-----
2100 '      CHECK WHETHER THERE ARE MORE BYTES TO
2110 '      TO BE READ--I.E. NEXT BYTE IS $1.
2120 '      IF SO, GET NUMBER OF BYTES, AND SKIP
2130 '      LOADING ADDRESS--I.E. ASSUME IT FOLLOWS
2140 '      SEQUENTIALLY. IF NO MORE BYTES, THEN
2150 '      ENDING ROUTINE: PRINT CRITICAL VALUES
2160 '
2170 C=ASC(MID$(AS(K),N,1))
2180 IF C<>1 THEN 2240
      ELSE N=N+1
2190 NB=ASC(MID$(AS(K),N,1))
2200 IF NB=0 THEN NB=254
      ELSE NB=NB-2
2210 KB=0
2220 N=N+1
2230 RETURN
2240 CLOSE
2250 CLS
2260 PRINT"FOR USER FUNCTION: DEFUSRN = 68";ST$
2270 PRINT CHR$(13);"POKE VALUES FROM ",ST;"TO ",EN
2280 PRINT CHR$(13);"MEMORY SIZE: ",MM
2290 PRINT CHR$(13);"MERGE";CHR$(34);F$;CHR$(34);CHR$(13)
2300 END

```

```

1000 '      ** THE POKE PROGRAM **
1010 '
1020 DEFINT A-Z
1030 INPUT"LINE 1000 OKAY? (ENTER) OR BREAK";QS
1040 INPUT"START AND END ADDRESSES";S,E
1050 FOR I=S TO E
1060 READ N : POKE I,N
1070 NEXT I
1080 DEFUSR1=
1090 K=USR1(0)
1100 END

```

Program Listing 2. The POKE program.

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Basic, Faster and Readable—Part IV

by John Corbani

(The first three parts of this series appeared in June, p. 104, July, p. 200, and November, p. 228.—Eds.)

The intelligent use of variables in your programs is essential to both program speed and readability. The type and number of variables and their sequence affects execution time. Creating mnemonic variables that are easy to read, remember, and understand is essential to good programming.

In this article I look at the Model I/III version of Microsoft Basic and describe how Basic puts variables into memory and how to use variables so your computer reads them faster.

A variable name represents either a number (numeric variable) or a sequence of printable, or control, characters (string variables). Basic uses variables in program statements to represent different values. The concept is the same as that used in algebra.

The formula for adding three quantities illustrates the use of variables. $A + B + C = D$ uses A, B, and C to represent values you want added together, and specifies D to represent the answer.

If you assign A the value 2, B the value 3, and C the value 5, then D equals 10 in the above formula. If A = "B" and B = "O" and C = "Y" then D equals "BOY". You can change the number or characters represented by these variables, run the variables through a formula, and obtain general solutions to problems.

Numeric Variables

Three types of numeric variables exist: integer, single-precision, and double-precision. Integer variables describe whole numbers between -32768 and +32767. Basic processes these variables very quickly.

Using variables in a Basic program can affect execution speed. Make sure you use them efficiently.

Single-precision variables consist of any six digits and can contain a decimal point. They take longer to process than integer variables.

Double-precision variables use 16 digits with a floating decimal point and take the longest time to process, so use them only when necessary.

A numeric variable's name consists of one or two alphanumeric characters, with only two restrictions: the first character must be a letter, and you cannot use Basic reserved key words (If, To, Or, and so on).

Basic converts lowercase characters to uppercase. This allows for 26 single letter variables (A-Z), 260 alphanumeric (A0-Z9), and about 650 alpha/alpha combinations (AA-ZZ).

This total of 936 variables applies to each of the three types, bringing the total possible numeric variables to 2,808.

You have the choice of defining groups of variables as a specific numeric type, or adding an identifier (suffix) to the variable name every time you use it. If you do not specify a numeric type, Basic assumes a single-precision variable.

Use the DEFINT, DEFSNG, and DEFDBL commands to predefine groups of numeric variables as integer, single-, or double-precision.

The punctuation characters % (integer), ! (single-precision), and # (double-precision) are suffixes that you can add to variables to define their type. The listing below illustrates the use of these definitions and suffixes.

```
10 DEFINT A-C: DEFDBL X
20 A = -3: B! = 30: BA = 10: X = 1/3: X1 = 1:
   X2 = 3: X3 = X1/X2: PRINT A; B!; BA:
   PRINT X; X3
30 D = 1.666E3: X3 = 1.7563421D - 2: PRINT
   D; X3
```

Line 10 defines all simple variables (those without a suffix) starting with the letters A, B, and C as integer variables. All simple variables starting with X are double-precision. All other simple variables are, by default, single-precision.

Line 20 assigns values to four variables. It sets A to -3, an integer, and single-precision variable B to 30.0000. It also sets BA to the integer 10, and X to the double-precision value of .3333333432674408.

The computer divides constants in single-precision and converts them to double-precision or integers. If you want 1/3 to equal .3333333333333333, you have to type it in yourself or make your computer do the division with double-precision numbers.

Line 30 illustrates a shorthand method to enter data that comes in scientific notation. When you assign values to single-precision variables, you can type the number, an E, and the exponent.

In double-precision you use a D before the exponent. Basic sets the variable D to 1666.00 and the variable X3 to .017563421.

String Variables

String variables represent characters or sequences of characters. They can

represent from zero to 255 characters.

The rules for naming string variables are the same as those for numeric variables. Names can be either letters, an alphanumeric combination, or two letters that aren't reserved words.

Reserve groups of names for string variables by using the DEFSTR function (see the listing below). You can also identify a string variable by placing a \$ (read "string," not "dollar") after a variable name. Basic provides 936 string variables, bringing the total number of variables to 3,744.

```
40 DEFSTR F-H: G = "Good bye."
   : H = "Hello"
50 Y$ = "you all.": F = CHR$(191) + " "
60 PRINT F + H + Y$ + G
```

Line 40 defines all variables starting with the letters F-H as string variables, and assigns sequences of characters to G\$ and H\$.

Line 50 assigns a string to Y\$ and assigns character number 191 (a full white block) and two spaces to F\$. Line 60 uses the strings to print a block cursor and two sentences.

Arrays

Use numeric and string variables to identify arrays, or lists of values. The 3,744 possible arrays are in addition to the individual variables. Each array has as many as 255 dimensions, and 65,535 elements per dimension.

You don't need to define arrays with fewer than 11 elements per dimension. You must dimension arrays with any element number above 10 before referencing the high element.

If you define a variable as a certain type, you must dimension the variable array after that point as the same type unless otherwise specified by a suffix.

```
70 DIM A(20,2): DIM G(26)
80 FOR A = 1 TO 20: FOR B = 1 TO 2:
   A(A,B) = A * B: NEXT B,A
90 FOR A = 1 TO 26: G(A) = CHR$(A + 64):
   NEXT
```

Line 70 dimensions two arrays. A(20,2) is a two-dimensional integer numeric array. G(26) is a single-dimensional string array. Remember, line 10 defines A as an integer and line 40 defines G as a string variable.

Line 80 fills the numeric array with the numbers from 1-20 in one dimension and the square of the numbers in the other dimension. Line 90 fills the string array with the code for the capital letters from A-Z.

Basic stores in memory all the variables

and arrays specified in a program, along with the information they represent. Basic stores numeric variables just after the program that defines them. The storage process occurs as the program uses each variable.

The program stores variables in memory in the order in which it encounters them. Each name takes 3 bytes: 1 for the variable type, and 2 for the name. The value assigned to numeric variables immediately follows.

Basic stores integer values in the next 2 bytes, single-precision in the next 4 bytes, and double-precision in the next 8 bytes. The length of the string in 1 byte and the address of the first character of the string in the 2 bytes follows the string variable's type and name. The program stores the data itself in high memory.

Basic stores arrays in a list following the simple variables. Three bytes identify the type of variable and the array name. Two bytes identify the total number of elements, and 1 byte identifies the number of dimensions. Basic also allocates 2 bytes for each dimension to give the number of elements allowed per dimension. The program stores the data, one element at a time, starting with the first dimension.

You can also use long names for the variables. Basic looks at the last character to determine type, and ignores all characters after the first two unless they are reserved (key) words. Microsoft gives more variables than most programs can use.

Why all the confusion about variables? Don't blame Basic, blame Fortran and the misinterpretation of books written by and for Fortran programmers. Fortran begat Basic, and contained only a few integer variables, starting at 1.

Fortran had no strings, and virtually no organized structure. It was one of the first high-level languages, and is still the language of choice in most state-of-the-art scientific applications.

Basic is an interpreter that uses much of Fortran's source code. It has greatly expanded the role and power of variables. It also includes Basic-added numeric and string types, and many of the old restrictions are gone. The literature could not keep up. Many of the current problems are due to human factors that have seldom been addressed.

Be careful not to use letters in situations that could cause confusion. Electronic connector manufacturers have noticed that people misread the letters G, I, O, and Q. G, O, and Q turn up as zero. I is a 1, and vice versa. Connector

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```
10 A% = 10: BC$ = "HELLO"
```

```
V = VARPTR(A%)
```

Memory Address	Value	Description
V-3	3	Integer type code
V-2	0	First letter of name (none)
V-1	65	Second character of name (A)
V	10	Low byte of the value
V+1	0	High byte of the value

```
V + VARPTR(BC$)
```

Memory Address	Value	Description
V-3	3	String type
V-2	66	First letter of name (B)
V-1	67	Second character of name (C)
V	6	Number of characters in string
V+1	254	Least significant byte of address of first letter of string (H)
V+2	121	Most significant byte of first letter of string (H) (H) is found at 254 + (121*256), or 30,976

Table 1. An example of integer and string storage in Basic.

```
10 DEFINT A, B, V: B = 1*0: V = 1*0: DIM A(10,2)
20 FOR A = 0 TO 10: A(A,0) = A + 1: A(A,1) = A + 21: A(A,2) = A + 41: NEXT
30 V = VARPTR(A(0,0))
40 FOR B = -10 TO 50: LPRINT PEEK(V+B):NEXT
```

Memory Address	Value	Description
V-10	2	Integer variable
V-9	0	Name
V-8	65	Name
V-7	71	Number of elements
V-6	0	Number of elements
V-5	2	Number of dimensions
V-4	3	Depth of dimension 2
V-3	0	Depth of dimension 2
V-2	11	Depth of dimension 1
V-1	0	Depth of dimension 1
V	1	First element A(0,0)
V+1	0	First element A(0,0)...
V+22	21	Element A(0,1)
V+23	0	Element A(0,1)...
V+44	41	Element A(0,2)
V+45	0	Element A(0,2)

Table 2. A two-dimensional integer array and associated values.

manufacturers use a 22-letter alphabet. That's the reason for the standard 44-pin connector.

I was the first of the few integers in Fortran, and since integers ran fast, they were used in most programming books as preferred variables. Everyone used them, and everyone had problems.

G is not too bad on screen or on fully formed character printers, but if you have a dot matrix printer, watch out. O is a disaster when used alone, and it's even worse when used as the second letter of a variable name.

Don't even consider Q unless the program context makes it unmistakable. QS for queen of spades in a poker program makes good sense, for instance.

I is just as bad. It makes a bad second letter, and can cause confusion when used alone. IN is a handy name for input data, and if the context is clear, I is a reasonable first letter.

The logical selection of variable names depends on the purpose of the program. Pick letters and combinations that form mnemonics recognizable to anyone familiar with the general subject area. X and Y are good names for variables that describe the X and Y plotting positions in a graphics package.

D or T makes sense for loop variables used for time delays. NMS is great for the name string in a mailing list program.

Whatever you do, keep a variables list in alphabetical order as you write a program, and put arrays in a separate list. You need to know what the variables are, what they represent, and how they're used. Never use the same name for two types of numerical variables.

Use the fewest number of variables possible to do the job. Nothing is wrong with specifying some variables as utility variables and using them repeatedly. Initialize them every time you use them and you'll never have a problem.

Variables can change function as a program executes. Just list all functions in the variables list. Variables and arrays take up valuable memory, whether used once or 1,000 times, so their efficiency is important. Remember, you can never recover memory during program execution.

Fewer variables mean higher speed. Basic interprets programs character by character. When it encounters a variable, the interpreter goes to the top of the variables list and starts searching for the name.

Variables used frequently or in time sensitive routines should be at the top of the list. If the variable is number 100 on the list, the program reads 99 variable names, compares them to the desired name, and discards them every time you reference that variable. Moving the variable up to 50 on the list doubles the speed of obtaining the quantity represented by that variable.

Assign critical values right at the start of the program. Remember to store string and numeric variables in different lists. Store string and numeric arrays in a separate list, and assign values accordingly.

Sometimes you'll want to know the location of a variable in memory. The POKE command can change the contents of strings, for example, or a machine-language routine might need access to some data in memory.

VARPTR(X) can get you to the right spot, but it's a tricky function to use. VARPTR(X) returns an error message if X is undefined in the program. If the program has not yet encountered X during the execution, VARPTR returns the memory location of the variable as part of the source code. This information is useless for determining type of value of the variable.

If all simple variables have values, and you use VARPTR to find an array, any answer you get is subject to change and may be wrong.

Assigning memory space to simple variables after arrays have been defined requires moving the array to make room for the simple variable. Table 1 shows how Basic stores an integer and a string. Table 2 shows a two-dimensional integer array.

Floating point numbers start with the least significant byte at location V. The number representation when playing with binary floating point numbers is too complex to go into here. Zilog and Intel have programming guides that can help, for those who are interested. Radio Shack information to date is superficial at best.

That's enough on variables. In my next installment, I will take a look at Basic commands that let you get right into the hardware of your computer. ■

John Corbani's hobbies include programming, radio controlled model aircraft, sailing, railroading, skiing, and windsurfing. You can reach him at 2455 Calle Linares, Santa Barbara, CA 93109.

Take It Off

by David Engelhardt

Model 4 owners may need or want more space on their TRSDOS 6.0 system disks. Killing infrequently used system utilities yields the extra space, but TRSDOS 6.0 protects these utilities with a password. Before you can rearrange your disks, you must circumvent this protection. I'll show you how.

Figure 1 shows the directory listing of an unaltered 6.0 disk. The letter P in the attribute (Attr) column identifies protected files.

The Concept

Debug on TRSDOS 6.0 is more powerful than the Model III version. It

You can gain extra space on TRSDOS 6.0 disks by killing protected utility files. Here's how.

includes a new set of features, including a disk Read/Write utility. By taking advantage of this utility in 6.0's revised Debug, you bring the system directory into memory, remove the password, and write the modified directory back to the disk.

Your TRSDOS 6.0 manual discusses this utility on pages 1-75. When you invoke a disk utility command, you must specify six parameters relevant to the operation that tell 6.0 how to proceed. You need to indicate the number of the disk drive, the cylinder number, the starting sector, the type of operation you want to perform, the memory address, and the number of sectors.

The Read/Write utility allows a possibility of four disk drives, 0-3.

TRSDOS 6.0's name for tracks is cylinders, and you must cite cylinder values in hexadecimal (hex) units. Therefore, the range of possible cylinders on a 40-track disk is 0-27 hex.

The starting sector indicates where you want to begin reading from the disk.

The Read/Write utility performs three operations: it writes to a disk (the W command), reads from a disk (R), and writes to the directory (*).

The address value tells the system where in memory to load the information read from the disk. Again, this value must be hexadecimal.

You control how much of a disk the system reads by specifying a number of sectors. If you don't specify, the program reads a whole cylinder (18 sectors). Since sectors are numbered 0-17, selecting a sector number greater than 17 tells the software to continue reading onto the next cylinder.

Removing the Protection

Begin the unprotecting process with a little insurance. Instead of altering your original disk, make a back-up copy and use that. If anything goes wrong while you're tampering with the disk directory, you won't be able to recover the working disk.

Place the back-up in drive zero. Type the command FREE :0 to determine which cylinder holds the directory. The

Drive :#	TRBDOS#	40	Cyl	DDEN	Free =	43.50K /	189.89K	Date	18-Mar-83	
Filespec	MOD	Attr	Prot	LRL	#Recs	EOF	File Size	Ext	Mod Date	
BAR/BAS			FULL	256	8	0	8.00K	1		
CLICK/PLT	P	EXEC	256	2	170	1.50K	1	18-Mar-83		
COM/DVR	P	EXEC	256	4	45	1.50K	1	18-Mar-83		
COMR/CMD	P	EXEC	256	12	2	3.00K	1	19-Mar-83		
CONV/CMD	P	EXEC	256	7	38	3.00K	1	18-Mar-83		
FLOPPY/DCI	P	READ	256	3	35	1.50K	1	18-Mar-83		
FORMS/PLT	P	EXEC	256	4	35	1.50K	1	18-Mar-83		
BERT158/JCL	P	FULL	256	2	174	1.50K	1	19-Mar-83		
KSM/PLT	P	EXEC	256	4	44	1.50K	1	19-Mar-83		
LOG/CMD	P	EXEC	256	2	94	1.50K	1	18-Mar-83		
MAILLIST			FULL	256	64	87	16.50K	1	18-Mar-83	
MAILLIST/DAT	?		FULL	256	1	255	1.50K	1	23-Apr-83	
MEMDISK/DCI	P	READ	256	12	149	3.00K	1	18-Mar-83		
REPAIR/CMD	P	EXEC	256	3	88	1.50K	1	18-Mar-83		
TAPE100/CMD	P	EXEC	256	9	72	3.00K	1	18-Mar-83		

15 files out of 37 selected. Space = 42.89K										

15 files out of 37 selected, Space = 42.89K

Figure 1. TRSDOS 6.0 directory listing.

```

6200 58 03 53 28 00 42 4F 4F 54 20 20 20 20 53 59 53 7.S(.BOOT SYS
6210 F6 37 F5 9C 0F 00 00 02 FF FF FF FF FF FF FF FF 7.S.....
6220 5F 03 53 89 00 53 59 53 36 20 20 20 20 53 59 53 7.S.SYS6 SYS
6230 F6 37 F5 9C 30 00 16 07 FF FF FF FF FF FF FF FF 7.S.....
6240 15 03 53 96 00 4D 45 4D 44 49 53 48 20 44 43 54 7.S.MEMDISK DCI
6250 BF AE 96 42 0C 00 00 01 FF FF FF FF FF FF FF FF 7.S.....
6260 16 03 53 59 09 52 45 50 41 49 52 20 20 43 4D 44 7.S.REPAIR CMD
6270 BF AE 96 42 0C 00 09 49 FF FF FF FF FF FF FF FF 7.S.....
6280 16 03 53 2E 00 43 4F 4D 20 20 20 20 20 44 56 52 7.S.COM DVR
6290 51 1F 96 42 04 00 0C 20 FF FF FF FF FF FF FF FF 7.S.....
62A0 16 03 53 49 00 54 41 50 45 31 30 30 20 43 4D 44 7.S.TAPE100 CMD
62B0 BF AE 96 42 0C 00 0A 01 FF FF FF FF FF FF FF FF 7.S.....
62C0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 7.S.....
62D0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 7.S.....
62E0 16 03 53 5F 00 4C 4F 47 20 20 20 20 20 43 4D 44 7.S.LOG CMD
62F0 BF AE 96 42 02 00 09 0F FF FF FF FF FF FF FF FF 7.S.....

```

Figure 2. Debug display.

directory location is labelled DDD, and is usually at cylinder 20.

At the TRSDOS Ready prompt, type DEBUG (ON,EXT) and press the enter key. The Debug monitor loads, then control passes back to the Ready prompt. Press the break key to enter the Debug monitor and a three-quarters screen display of the Z80 register values appears.

Type F6000,7800,00 and press the enter key. This clears the memory you want to use.

Load the disk's directory into memory using the Disk Read/Write utility command: 0,14,0,R,6000,17 and press the enter key. The software reads disk cylinder 14 hex and places the information in memory beginning at 6000 hex. Then the utility displays the contents of memory, starting at 6000 hex—this is the disk's directory.

Pressing the semicolon key increments the display 256 bytes of memory at a time; the hyphen key decrements the display by 256 bytes. Step through memory until the starting address of 6200 hex appears on the screen.

In the far right column, the file names appear in ASCII format. As you step through memory, the names of all

the disk's files show up. Notice that some of these names don't appear when you take a directory of the disk. See your manual's explanation of the DIR command for more about these "invisible" files.

Figure 2 shows the Debug display of memory beginning at 6200 hex. This includes the directory information for the utilities Memdisk, Repair, Com, Tape-100, and Log. The line on which the ASCII file name appears represents the beginning of each directory entry.

Looking at the first byte in the first line of each utility, notice Memdisk begins with a 15; Repair, Com, Tape-100, and Log begin with 16. This byte tells the system the program's protection level. Changing this changes the program's protection. If the value is 10 hex, the program is completely accessible.

Try unprotecting Memdisk for practice. Type E6240 and press the space bar to set Debug's pointer to Memdisk's first line. Notice that the current byte value appears at the lower left of the screen.

Type 10 and press the enter key. The display reflects the change you made. The first byte of Memdisk is 10, mean-

ing that Memdisk is now unprotected.

Type E6260 and press the space bar. The pointer moves to the beginning of the Repair utility. Change its initial byte to 10. Continue making these changes until you alter all the utility programs. Remember: You've made these changes in memory only, not on the disk.

To replace the disk's directory with your modified directory, use another disk Read/Write utility command. It's almost the same as the one that puts the directory in memory. Just change the operator from R to an asterisk. Type 0,14,0,*,6000,17 and press the enter key. Type the letter O and press the enter key to return to TRSDOS Ready. Turn off Debug using the command DEBUG (OFF).

Call the directory using the DIR command and you see that the programs you changed no longer have the P attribute. You are free to copy or kill them at your discretion.

Use this technique to customize your 6.0 disks to suit your needs.

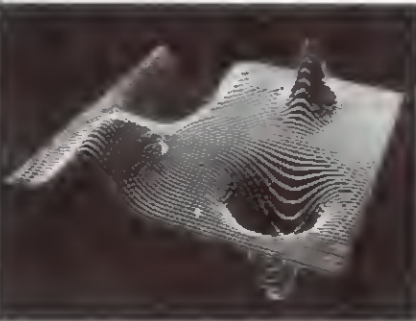
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Contact David Engelhardt at 10221 W. 101st Place, Broomfield, CO 80020.

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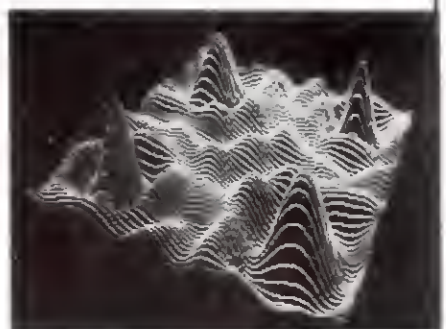
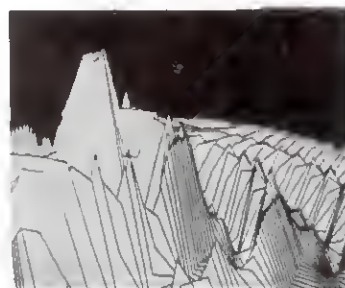
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The Password Is...

by David Lantis

At one time or another, you've probably run across a Model 4 disk file you wanted to list but couldn't because it was password-protected. One way to gain access is to remove the password protection, but that leaves the files open to anyone.

A better solution is to use this Basic program and the Memdisk utility to uncover the password. This leaves your files protected against accidents, while still giving you complete freedom.

Program Operation

PASSCRCK/BAS (see the Program Listing) searches for the password of a protected file on the disk in drive zero. The program systematically tries every possible combination of letters and numbers until it hits upon the successful one.

The On Error and Resume statements in lines 10 and 5000, respectively, are PASSCRCK/BAS's key. They keep the program running as long as it makes errors, i.e., as long as it generates an incorrect password.

Lines 30-160 loop around, testing every possible alphanumeric value for each of seven possible password characters (stored in variables C2-C8). Line 170, the loop that tests the value of the first character (C1), is different from those in the previous lines because TRSDOS 6.0 requires that a letter begin a password.

Lines 180-200 tally the values of the individual characters (C1-C8) into P\$, the variable that holds the password possibility currently being tested. Line 210 is optional; it prints P\$ on the screen. While it's helpful to know how far along the program is, this line does slow execution.

Line 220 sets the variable FILE\$ equal to the command that lists your selected program, LIST FILE NAME/EXTENSION PASSWORD, where password is the possibility the program tests.

Line 230 goes out to the system to test the password. If the program is successful, then the program listing appears on the screen. Finally, the software prints the line LIST FILE NAME/EXTENSION PASSWORD at the top of the screen. Get a pencil and write down the password.

Unfortunately, this program is slow. It tests tens of thousands of possible combinations of letters and numbers. In addition to the time it takes to test the password, the disk drives wait one second between the time they start spinning and the time they begin reading the disk. Multiply this second across the number of password possibilities tested and we're talking about hours, maybe days.

Speeding Things Up

Memdisk, a TRSDOS 6.0 utility, helps speed things by creating a pseudo-disk in memory. This circumvents the physical disk I/O that takes so much time. Your TRSDOS 6.0 manual documents the Memdisk utility on page A-116.

To run PASSCRCK/BAS with Memdisk, move the system files, Basic's error reporting overlay BASIC/OVI, and the program you want to crack into memory on Memdisk. (If BASIC/OVI is protected on your disk, remove the protection using the method described above.)

Type SYSTEM (DRIVE=2, DRIVER="MEMDISK") and press the enter key. The Memdisk utility menu appears. Choose option D, specify a double-density Memdisk (type D again), and respond Y to the format request. If you ask for a directory (DIR), you see that drive 2 now contains Memdisk.

Type in BACKUP \$/SYS:0 :2 (SYS) to tell the computer to copy all system files onto disk 2, the disk in memory.

Typing in BACKUP BASIC/OVI:0 :2 moves the Basic overlay program onto Memdisk. This circumvents the physical disk I/O involved when PASSCRCK/BAS fails and BASIC/OVI reports, "Access denied due to password protection."

Type in BACKUP file/ext:0 :2 (where file is the name of the program you're cracking) to move the program onto Memdisk.

Typing in SYSTEM (SYSTEM=2) installs Memdisk as drive zero. Requesting a directory now shows physical drive zero as drive 2 and Memdisk as drive zero.

Type in BASIC/CMD:2 to run Basic. Then, from Basic's READY prompt, load and run PASSCRCK/BAS. When the program asks "File you wish to list?" enter the name of the program you want to crack.

With the Memdisk method implemented, PASSCRCK/BAS tests about 100 passwords per minute. Carried to its ultimate end, the program reaches its final possibility (password ZZZZZZZZ) in approximately 1,041 years. But the chances are that the software will encounter the correct password well before then. ■

```
10 ON ERROR GOTO 5000
20 INPUT "What file to list -- must be on disk 8";P$
30 FOR C8=32 TO 96
40 IF (C8>32 AND C8<48) OR (C8>57 AND C8<65) THEN 320
50 FOR C7=32 TO 96
60 IF (C7>32 AND C7<48) OR (C7>57 AND C7<65) THEN 310
70 FOR C6=32 TO 96
80 IF (C6>32 AND C6<48) OR (C6>57 AND C6<65) THEN 300
90 FOR C5=32 TO 96
100 IF (C5>32 AND C5<48) OR (C5>57 AND C5<65) THEN 290
110 FOR C4=32 TO 96
120 IF (C4>32 AND C4<48) OR (C4>57 AND C4<65) THEN 280
130 FOR C3=32 TO 96
140 IF (C3>32 AND C3<48) OR (C3>57 AND C3<65) THEN 270
150 FOR C2=32 TO 96
160 IF (C2>32 AND C2<48) OR (C2>57 AND C2<65) THEN 260
170 FOR C1=65 TO 96
180 P$=CHR$(C1)+CHR$(C2)+CHR$(C3)+CHR$(C4)
190 P$=CHR$(C5)+CHR$(C6)+CHR$(C7)+CHR$(C8)
200 P$=P$+P$
210 PRINT P$
220 FILE$="list "+P$+"."+"P$
230 SYSTEM FILE$
240 PRINT FILE$: END
250 NEXT C1
260 NEXT C2
270 NEXT C3
280 NEXT C4
290 NEXT C5
300 NEXT C6
310 NEXT C7
320 NEXT C8
330 PRINT "Couldn't find the password, I guess you'll have to fi
re me":END
5000 RESUME 250
```

Program Listing. Password Sleuth.

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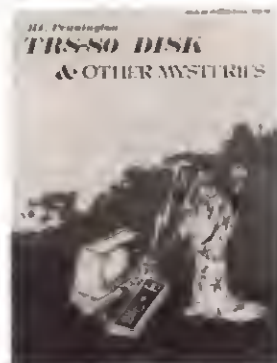
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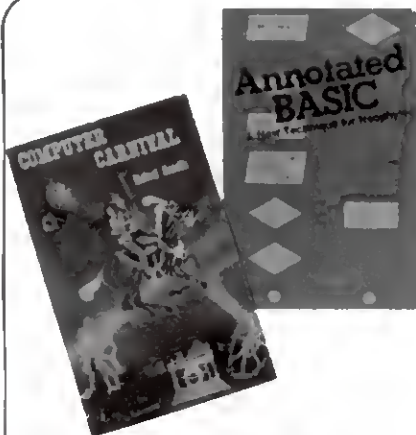


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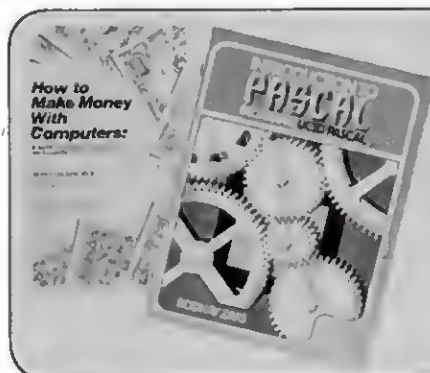
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Continued from p. 115

The program identifies the string even though the search key "walk" is only a substring of the word "walks". This is an important feature of the signature screening method. You need to specify only three or more letters of a word to find it. The substring can be from any position in the word.

The detective who helped us earlier has gone home to watch reruns of Perry Mason, and it's time to get to work. First, I'll describe the general aspects of implementing signature screening on 8-bit machines. I'll follow this with an explanation and complete Assembly-language listings of two signature screening programs (Mindex and Search) for the Models II, I2, 16, III, and 4.

Finally I'll give instructions on using the programs, suggest potential applications, and venture a prediction on how personal computers will store and retrieve textual information in the future.

Start with a simple case in which each text record is 255 or fewer bytes and is

The index file has the same name and password as the source file, but the extension MAP. The first sector of the index file, called the header, contains the name and version of the indexing program (Mindex 1.2) and the source file's file specification. The source file's drive number isn't included since the user might wish to switch drives.

Neither Mindex nor Search uses the 5 bytes (251 to 255) at the end of each signature sector. In Fig. 5, you can find the signature of the first source record (sector zero) by reading the first bit (bit



Figure 4. Record signatures of the three strings in Table 2 and key signatures of the search keys "Jill" and "walks + lane".

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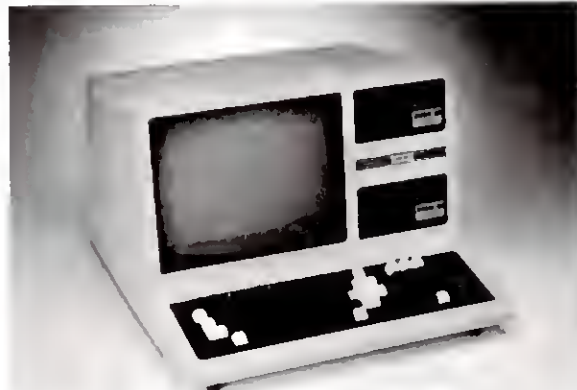
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zero) of each of the bytes in the first signature sector.

Indexing

I'll index the file in Fig. 5. First, the program reserves a 256-byte buffer in memory for the signature sector. After it opens the source and index files and writes the index file header sector, the program starts indexing.

The program sets all the bytes in the signature sector buffer to zero. The program reads the first source file record into memory. It then hashes each triplet in the source record to a number between zero and 250, and sets bit zero of the corresponding byte in the signature sector buffer to 1. In the first source record the triplets "bir" and "ird" hash to 171 and 194, respectively, so the program sets the first bits of bytes 171 and 194 of the signature sector to 1.

After the program processes the first record, it reads the second record (sector 1) into memory. Again, the program hashes each triplet in the record, but this time the program sets bit 1 of the corresponding byte equal to 1. The triplet "cat" hashes to 193 so the program sets bit 1 of byte 193 of the signature sector

to 1.

The program repeats this procedure until it indexes eight of the records. It then stores the signature sector buffer in the index file (sector 1). The program processes the next eight sectors of the source file in the same manner, and sequentially stores the signature sector in the index file. Indexing continues until the end of the source file, then the program writes the last signature sector to the index file and closes both files.

Searching

Remember that in its simplest form the search algorithm is: Match the signature of the first record to the key signature. If, for every b_i equal to 1 in the key signature, you have a corresponding b_i equal to 1 in the record signature, the screening test is positive and the program brings the record into memory and searches it for the key.

An ideal way to compare the key signature to a record signature is to have a machine with 251-bit registers and accumulators. You could compare the key and record signatures in one operation.

Search key	Jill	
Triplets	jil	ill
Hash values	212	142
Key hash buffer	21 14 22	

Figure 6. Search key "Jill" for search of the source file in Fig. 5.

It would be a form of parallel processing—the same as putting multiple needles in edge-notched cards and selecting only those cards that fall out.

Eight-bit machines, however, necessitate the use of serial processing. Although a program can sequentially compare all 251 bits of the key and record signatures, it would be wasteful because the majority of bits in the key signature are set to zero and can be ignored.

Instead, the program stores the hash values of all triplets in the search key in a separate buffer called the key hash buffer (Fig. 6). If, for each hash value in the key hash buffer, the corresponding

Listing 3 continued

```

00062      ;-----
00063      ;MODII buffers
00064      ;-----
00065      PUBLIC ACCESS
00066      ;break enabled buffer (Y/N)
00067      PUBLIC INDCB
00068      ;input file DCR Record Length
00069      PUBLIC INDCR
00070      ;input file DCR Current Record
00071      PUBLIC INCLR
00072      ;true last record of source file
00073      PUBLIC INCRS
00074      ;MAP (index) file DCR
00075      PUBLIC INDCR
00076      ;MAP file DCR Record Length
00077      PUBLIC INDCR
00078      ;MAP file DCR Current Record
00079      PUBLIC INDCR
00080      ;true last record of index file
00081      ;start of record line no.
00082      PUBLIC OUTCR
00083      ;output file DCR
00084      ;printer buffer (96 char)
00085      PUBLIC PTRBUF
00086      ;start of MAP index file (always last byte
00087      ;of SEARCH program)
00088      ;-----
00089      ;MODII I/O parm
00090      ;-----
00091      PUBLIC ARROWD
00092      ;arrow down
00093      PUBLIC ARROWL
00094      ;arrow left
00095      PUBLIC ARROWR
00096      ;arrow right
00097      PUBLIC ARROWU
00098      ;arrow up
00099      PUBLIC BKKEY
00100      ;break key
00101      PUBLIC BSKEY
00102      ;backspace key
00103      PUBLIC CYPPOS
00104      ;copyright notice position
00105      PUBLIC DEKEY
00106      ;delete key
00107      PUBLIC DFTS
00108      ;default file size
00109      PUBLIC INKEY
00110      ;insert key
00111      PUBLIC LBYTE
00112      ;col of last byte in 255 byte rec
00113      PUBLIC PENUL
00114      ;penultimate line (next to bottom)
00115      PUBLIC SWIDTH
00116      ;screen width
00117      PUBLIC SML
00118      ;screen width minus 1
00119      PUBLIC TOPLN
00120      ;top line of editor screen
00121      ;-----
00122      ;external routines and buffers
00123      ;referenced by MODII
00124      ;-----
00125      EXTERN ANSWER
00126      ;general purpose 1 byte buffer
00127      EXTERN EATBNK
00128      ;bypass leading blanks
00129      EXTERN EATBNK
00130      ;bypass leading non-blank char
00131      ;Model II equates
00132      ;-----
00133      ARROWD EQU 1FH
00134      ;arrow down
00135      ARROWL EQU 1CH
00136      ;arrow left
00137      ARROWR EQU 1DH
00138      ;arrow right
00139      ARROWU EQU 1EH
00140      ;arrow up
00141      BKKEY EQU 3
00142      ;break key
00143      BSKEY EQU 80
00144      ;backspace key
00145      CYPPOS EQU 79
00146      ;copyright notice position
00147      DEKEY EQU 19
00148      ;delete key (F2)
00149      DFTS EQU 22
00150      ;default file size for 3bys
00151      INKEY EQU 14
00152      ;insert key (F1)
00153      LBYTE EQU 800
00154      ;col of last byte in 255 byte rec
00155      PENUL EQU 255
00156      ;penultimate line
00157      SWIDTH EQU 80
00158      ;screen width
00159      SML EQU 79
00160      ;screen width minus 1
00161      TOPLN EQU 19
00162      ;top line of edit text
00163      ;-----
00164      ;MODII I/O parm
00165      ;-----
00166      PUBLIC ARROWD
00167      ;arrow down
00168      PUBLIC ARROWL
00169      ;arrow left
00170      PUBLIC ARROWR
00171      ;arrow right
00172      PUBLIC ARROWU
00173      ;arrow up
00174      PUBLIC BKKEY
00175      ;break key
00176      PUBLIC BSKEY
00177      ;backspace key
00178      PUBLIC CYPPOS
00179      ;copyright notice position
00180      PUBLIC DEKEY
00181      ;delete key
00182      PUBLIC DFTS
00183      ;default file size
00184      PUBLIC INKEY
00185      ;insert key
00186      PUBLIC LBYTE
00187      ;col of last byte in 255 byte rec
00188      PUBLIC PENUL
00189      ;penultimate line (next to bottom)
00190      PUBLIC SWIDTH
00191      ;screen width
00192      PUBLIC SML
00193      ;screen width minus 1
00194      PUBLIC TOPLN
00195      ;top line of editor screen
00196      ;-----
00197      ;external routines and buffers
00198      ;referenced by MODII
00199      ;-----
00200      EXTERN ANSWER
00201      ;general purpose 1 byte buffer
00202      EXTERN EATBNK
00203      ;bypass leading blanks
00204      EXTERN EATBNK
00205      ;bypass leading non-blank char
00206      ;Model II equates
00207      ;-----
00208      ARROWD EQU 1FH
00209      ;arrow down
00210      ARROWL EQU 1CH
00211      ;arrow left
00212      ARROWR EQU 1DH
00213      ;arrow right
00214      ARROWU EQU 1EH
00215      ;arrow up
00216      BKKEY EQU 3
00217      ;break key
00218      BSKEY EQU 80
00219      ;backspace key
00220      CYPPOS EQU 79
00221      ;copyright notice position
00222      DEKEY EQU 19
00223      ;delete key (F2)
00224      DFTS EQU 22
00225      ;default file size for 3bys
00226      INKEY EQU 14
00227      ;insert key (F1)
00228      LBYTE EQU 800
00229      ;col of last byte in 255 byte rec
00230      PENUL EQU 255
00231      ;penultimate line
00232      SWIDTH EQU 80
00233      ;screen width
00234      SML EQU 79
00235      ;screen width minus 1
00236      TOPLN EQU 19
00237      ;top line of edit text
00238      ;-----
00239      ;MODII I/O parm
00240      ;-----
00241      PUBLIC ARROWD
00242      ;arrow down
00243      PUBLIC ARROWL
00244      ;arrow left
00245      PUBLIC ARROWR
00246      ;arrow right
00247      PUBLIC ARROWU
00248      ;arrow up
00249      PUBLIC BKKEY
00250      ;break key
00251      PUBLIC BSKEY
00252      ;backspace key
00253      PUBLIC CYPPOS
00254      ;copyright notice position
00255      PUBLIC DEKEY
00256      ;delete key
00257      PUBLIC DFTS
00258      ;default file size
00259      PUBLIC INKEY
00260      ;insert key
00261      PUBLIC LBYTE
00262      ;col of last byte in 255 byte rec
00263      PUBLIC PENUL
00264      ;penultimate line (next to bottom)
00265      PUBLIC SWIDTH
00266      ;screen width
00267      PUBLIC SML
00268      ;screen width minus 1
00269      PUBLIC TOPLN
00270      ;top line of editor screen
00271      ;-----
00272      ;external routines and buffers
00273      ;referenced by MODII
00274      ;-----
00275      EXTERN ANSWER
00276      ;general purpose 1 byte buffer
00277      EXTERN EATBNK
00278      ;bypass leading blanks
00279      EXTERN EATBNK
00280      ;bypass leading non-blank char
00281      ;Model II equates
00282      ;-----
00283      ARROWD EQU 1FH
00284      ;arrow down
00285      ARROWL EQU 1CH
00286      ;arrow left
00287      ARROWR EQU 1DH
00288      ;arrow right
00289      ARROWU EQU 1EH
00290      ;arrow up
00291      BKKEY EQU 3
00292      ;break key
00293      BSKEY EQU 80
00294      ;backspace key
00295      CYPPOS EQU 79
00296      ;copyright notice position
00297      DEKEY EQU 19
00298      ;delete key (F2)
00299      DFTS EQU 22
00300      ;default file size for 3bys
00301      INKEY EQU 14
00302      ;insert key (F1)
00303      LBYTE EQU 800
00304      ;col of last byte in 255 byte rec
00305      PENUL EQU 255
00306      ;penultimate line
00307      SWIDTH EQU 80
00308      ;screen width
00309      SML EQU 79
00310      ;screen width minus 1
00311      TOPLN EQU 19
00312      ;top line of edit text
00313      ;-----
00314      ;MODII I/O parm
00315      ;-----
00316      PUBLIC ARROWD
00317      ;arrow down
00318      PUBLIC ARROWL
00319      ;arrow left
00320      PUBLIC ARROWR
00321      ;arrow right
00322      PUBLIC ARROWU
00323      ;arrow up
00324      PUBLIC BKKEY
00325      ;break key
00326      PUBLIC BSKEY
00327      ;backspace key
00328      PUBLIC CYPPOS
00329      ;copyright notice position
00330      PUBLIC DEKEY
00331      ;delete key
00332      PUBLIC DFTS
00333      ;default file size
00334      PUBLIC INKEY
00335      ;insert key
00336      PUBLIC LBYTE
00337      ;col of last byte in 255 byte rec
00338      PUBLIC PENUL
00339      ;penultimate line (next to bottom)
00340      PUBLIC SWIDTH
00341      ;screen width
00342      PUBLIC SML
00343      ;screen width minus 1
00344      PUBLIC TOPLN
00345      ;top line of editor screen
00346      ;-----
00347      ;external routines and buffers
00348      ;referenced by MODII
00349      ;-----
00350      EXTERN ANSWER
00351      ;general purpose 1 byte buffer
00352      EXTERN EATBNK
00353      ;bypass leading blanks
00354      EXTERN EATBNK
00355      ;bypass leading non-blank char
00356      ;Model II equates
00357      ;-----
00358      ARROWD EQU 1FH
00359      ;arrow down
00360      ARROWL EQU 1CH
00361      ;arrow left
00362      ARROWR EQU 1DH
00363      ;arrow right
00364      ARROWU EQU 1EH
00365      ;arrow up
00366      BKKEY EQU 3
00367      ;break key
00368      BSKEY EQU 80
00369      ;backspace key
00370      CYPPOS EQU 79
00371      ;copyright notice position
00372      DEKEY EQU 19
00373      ;delete key (F2)
00374      DFTS EQU 22
00375      ;default file size for 3bys
00376      INKEY EQU 14
00377      ;insert key (F1)
00378      LBYTE EQU 800
00379      ;col of last byte in 255 byte rec
00380      PENUL EQU 255
00381      ;penultimate line
00382      SWIDTH EQU 80
00383      ;screen width
00384      SML EQU 79
00385      ;screen width minus 1
00386      TOPLN EQU 19
00387      ;top line of edit text
00388      ;-----
00389      ;MODII I/O parm
00390      ;-----
00391      PUBLIC ARROWD
00392      ;arrow down
00393      PUBLIC ARROWL
00394      ;arrow left
00395      PUBLIC ARROWR
00396      ;arrow right
00397      PUBLIC ARROWU
00398      ;arrow up
00399      PUBLIC BKKEY
00400      ;break key
00401      PUBLIC BSKEY
00402      ;backspace key
00403      PUBLIC CYPPOS
00404      ;copyright notice position
00405      PUBLIC DEKEY
00406      ;delete key
00407      PUBLIC DFTS
00408      ;default file size
00409      PUBLIC INKEY
00410      ;insert key
00411      PUBLIC LBYTE
00412      ;col of last byte in 255 byte rec
00413      PUBLIC PENUL
00414      ;penultimate line (next to bottom)
00415      PUBLIC SWIDTH
00416      ;screen width
00417      PUBLIC SML
00418      ;screen width minus 1
00419      PUBLIC TOPLN
00420      ;top line of editor screen
00421      ;-----
00422      ;external routines and buffers
00423      ;referenced by MODII
00424      ;-----
00425      EXTERN ANSWER
00426      ;general purpose 1 byte buffer
00427      EXTERN EATBNK
00428      ;bypass leading blanks
00429      EXTERN EATBNK
00430      ;bypass leading non-blank char
00431      ;Model II equates
00432      ;-----
00433      ARROWD EQU 1FH
00434      ;arrow down
00435      ARROWL EQU 1CH
00436      ;arrow left
00437      ARROWR EQU 1DH
00438      ;arrow right
00439      ARROWU EQU 1EH
00440      ;arrow up
00441      BKKEY EQU 3
00442      ;break key
00443      BSKEY EQU 80
00444      ;backspace key
00445      CYPPOS EQU 79
00446      ;copyright notice position
00447      DEKEY EQU 19
00448      ;delete key (F2)
00449      DFTS EQU 22
00450      ;default file size for 3bys
00451      INKEY EQU 14
00452      ;insert key (F1)
00453      LBYTE EQU 800
00454      ;col of last byte in 255 byte rec
00455      PENUL EQU 255
00456      ;penultimate line
00457      SWIDTH EQU 80
00458      ;screen width
00459      SML EQU 79
00460      ;screen width minus 1
00461      TOPLN EQU 19
00462      ;top line of edit text
00463      ;-----
00464      ;MODII I/O parm
00465      ;-----
00466      PUBLIC ARROWD
00467      ;arrow down
00468      PUBLIC ARROWL
00469      ;arrow left
00470      PUBLIC ARROWR
00471      ;arrow right
00472      PUBLIC ARROWU
00473      ;arrow up
00474      PUBLIC BKKEY
00475      ;break key
00476      PUBLIC BSKEY
00477      ;backspace key
00478      PUBLIC CYPPOS
00479      ;copyright notice position
00480      PUBLIC DEKEY
00481      ;delete key
00482      PUBLIC DFTS
00483      ;default file size
00484      PUBLIC INKEY
00485      ;insert key
00486      PUBLIC LBYTE
00487      ;col of last byte in 255 byte rec
00488      PUBLIC PENUL
00489      ;penultimate line (next to bottom)
00490      PUBLIC SWIDTH
00491      ;screen width
00492      PUBLIC SML
00493      ;screen width minus 1
00494      PUBLIC TOPLN
00495      ;top line of editor screen
00496      ;-----
00497      ;external routines and buffers
00498      ;referenced by MODII
00499      ;-----
00500      EXTERN ANSWER
00501      ;general purpose 1 byte buffer
00502      EXTERN EATBNK
00503      ;bypass leading blanks
00504      EXTERN EATBNK
00505      ;bypass leading non-blank char
00506      ;Model II equates
00507      ;-----
00508      ARROWD EQU 1FH
00509      ;arrow down
00510      ARROWL EQU 1CH
00511      ;arrow left
00512      ARROWR EQU 1DH
00513      ;arrow right
00514      ARROWU EQU 1EH
00515      ;arrow up
00516      BKKEY EQU 3
00517      ;break key
00518      BSKEY EQU 80
00519      ;backspace key
00520      CYPPOS EQU 79
00521      ;copyright notice position
00522      DEKEY EQU 19
00523      ;delete key (F2)
00524      DFTS EQU 22
00525      ;default file size for 3bys
00526      INKEY EQU 14
00527      ;insert key (F1)
00528      LBYTE EQU 800
00529      ;col of last byte in 255 byte rec
00530      PENUL EQU 255
00531      ;penultimate line
00532      SWIDTH EQU 80
00533      ;screen width
00534      SML EQU 79
00535      ;screen width minus 1
00536      TOPLN EQU 19
00537      ;top line of edit text
00538      ;-----
00539      ;MODII I/O parm
00540      ;-----
00541      PUBLIC ARROWD
00542      ;arrow down
00543      PUBLIC ARROWL
00544      ;arrow left
00545      PUBLIC ARROWR
00546      ;arrow right
00547      PUBLIC ARROWU
00548      ;arrow up
00549      PUBLIC BKKEY
00550      ;break key
00551      PUBLIC BSKEY
00552      ;backspace key
00553      PUBLIC CYPPOS
00554      ;copyright notice position
00555      PUBLIC DEKEY
00556      ;delete key
00557      PUBLIC DFTS
00558      ;default file size
00559      PUBLIC INKEY
00560      ;insert key
00561      PUBLIC LBYTE
00562      ;col of last byte in 255 byte rec
00563      PUBLIC PENUL
00564      ;penultimate line (next to bottom)
00565      PUBLIC SWIDTH
00566      ;screen width
00567      PUBLIC SML
00568      ;screen width minus 1
00569      PUBLIC TOPLN
00570      ;top line of editor screen
00571      ;-----
00572      ;external routines and buffers
00573      ;referenced by MODII
00574      ;-----
00575      EXTERN ANSWER
00576      ;general purpose 1 byte buffer
00577      EXTERN EATBNK
00578      ;bypass leading blanks
00579      EXTERN EATBNK
00580      ;bypass leading non-blank char
00581      ;Model II equates
00582      ;-----
00583      ARROWD EQU 1FH
00584      ;arrow down
00585      ARROWL EQU 1CH
00586      ;arrow left
00587      ARROWR EQU 1DH
00588      ;arrow right
00589      ARROWU EQU 1EH
00590      ;arrow up
00591      BKKEY EQU 3
00592      ;break key
00593      BSKEY EQU 80
00594      ;backspace key
00595      CYPPOS EQU 79
00596      ;copyright notice position
00597      DEKEY EQU 19
00598      ;delete key (F2)
00599      DFTS EQU 22
00600      ;default file size for 3bys
00601      INKEY EQU 14
00602      ;insert key (F1)
00603      LBYTE EQU 800
00604      ;col of last byte in 255 byte rec
00605      PENUL EQU 255
00606      ;penultimate line
00607      SWIDTH EQU 80
00608      ;screen width
00609      SML EQU 79
00610      ;screen width minus 1
00611      TOPLN EQU 19
00612      ;top line of edit text
00613      ;-----
00614      ;MODII I/O parm
00615      ;-----
00616      PUBLIC ARROWD
00617      ;arrow down
00618      PUBLIC ARROWL
00619      ;arrow left
00620      PUBLIC ARROWR
00621      ;arrow right
00622      PUBLIC ARROWU
00623      ;arrow up
00624      PUBLIC BKKEY
00625      ;break key
00626      PUBLIC BSKEY
00627      ;backspace key
00628      PUBLIC CYPPOS
00629      ;copyright notice position
00630      PUBLIC DEKEY
00631      ;delete key
00632      PUBLIC DFTS
00633      ;default file size
00634      PUBLIC INKEY
00635      ;insert key
00636      PUBLIC LBYTE
00637      ;col of last byte in 255 byte rec
00638      PUBLIC PENUL
00639      ;penultimate line (next to bottom)
00640      PUBLIC SWIDTH
00641      ;screen width
00642      PUBLIC SML
00643      ;screen width minus 1
00644      PUBLIC TOPLN
00645      ;top line of editor screen
00646      ;-----
00647      ;external routines and buffers
00648      ;referenced by MODII
00649      ;-----
00650      EXTERN ANSWER
00651      ;general purpose 1 byte buffer
00652      EXTERN EATBNK
00653      ;bypass leading blanks
00654      EXTERN EATBNK
00655      ;bypass leading non-blank char
00656      ;Model II equates
00657      ;-----
00658      ARROWD EQU 1FH
00659      ;arrow down
00660      ARROWL EQU 1CH
00661      ;arrow left
00662      ARROWR EQU 1DH
00663      ;arrow right
00664      ARROWU EQU 1EH
00665      ;arrow up
00666      BKKEY EQU 3
00667      ;break key
00668      BSKEY EQU 80
00669      ;backspace key
00670      CYPPOS EQU 79
00671      ;copyright notice position
00672      DEKEY EQU 19
00673      ;delete key (F2)
00674      DFTS EQU 22
00675      ;default file size for 3bys
00676      INKEY EQU 14
00677      ;insert key (F1)
00678      LBYTE EQU 800
00679      ;col of last byte in 255 byte rec
00680      PENUL EQU 255
00681      ;penultimate line
00682      SWIDTH EQU 80
00683      ;screen width
00684      SML EQU 79
00685      ;screen width minus 1
00686      TOPLN EQU 19
00687      ;top line of edit text
00688      ;-----
00689      ;MODII I/O parm
00690      ;-----
00691      PUBLIC ARROWD
00692      ;arrow down
00693      PUBLIC ARROWL
00694      ;arrow left
00695      PUBLIC ARROWR
00696      ;arrow right
00697      PUBLIC ARROWU
00698      ;arrow up
00699      PUBLIC BKKEY
00700      ;break key
00701      PUBLIC BSKEY
00702      ;backspace key
00703      PUBLIC CYPPOS
00704      ;copyright notice position
00705      PUBLIC DEKEY
00706      ;delete key
00707      PUBLIC DFTS
00708      ;default file size
00709      PUBLIC INKEY
00710      ;insert key
00711      PUBLIC LBYTE
00712      ;col of last byte in 255 byte rec
00713      PUBLIC PENUL
00714      ;penultimate line (next to bottom)
00715      PUBLIC SWIDTH
00716      ;screen width
00717      PUBLIC SML
00718      ;screen width minus 1
00719      PUBLIC TOPLN
00720      ;top line of editor screen
00721      ;-----
00722      ;external routines and buffers
00723      ;referenced by MODII
00724      ;-----
00725      EXTERN ANSWER
00726      ;general purpose 1 byte buffer
00727      EXTERN EATBNK
00728      ;bypass leading blanks
00729      EXTERN EATBNK
00730      ;bypass leading non-blank char
00731      ;Model II equates
00732      ;-----
00733      ARROWD EQU 1FH
00734      ;arrow down
00735      ARROWL EQU 1CH
00736      ;arrow left
00737      ARROWR EQU 1DH
00738      ;arrow right
00739      ARROWU EQU 1EH
00740      ;arrow up
00741      BKKEY EQU 3
00742      ;break key
00743      BSKEY EQU 80
00744      ;backspace key
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00746      ;copyright notice position
00747      DEKEY EQU 19
00748      ;delete key (F2)
00749      DFTS EQU 22
00750      ;default file size for 3bys
00751      INKEY EQU 14
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00755      PENUL EQU 255
00756      ;penultimate line
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00760      ;screen width minus 1
00761      TOPLN EQU 19
00762      ;top line of edit text
00763      ;-----
00764      ;MODII I/O parm
00765      ;-----
00766      PUBLIC ARROWD
00767      ;arrow down
00768      PUBLIC ARROWL
00769      ;arrow left
00770      PUBLIC ARROWR
00771      ;arrow right
00772      PUBLIC ARROWU
00773      ;arrow up
00774      PUBLIC BKKEY
00775      ;break key
00776      PUBLIC BSKEY
00777      ;backspace key
00778      PUBLIC CYPPOS
00779      ;copyright notice position
00780      PUBLIC DEKEY
00781      ;delete key
00782      PUBLIC DFTS
00783      ;default file size
00784      PUBLIC INKEY
00785      ;insert key
00786      PUBLIC LBYTE
00787      ;col of last byte in 255 byte rec
00788      PUBLIC PENUL
00789      ;penultimate line (next to bottom)
00790      PUBLIC SWIDTH
00791      ;screen width
00792      PUBLIC SML
00793      ;screen width minus 1
00794      PUBLIC TOPLN
00795      ;top line of editor screen
00796      ;-----
00797      ;external routines and buffers
00798      ;referenced by MODII
00799      ;-----
00800      EXTERN ANSWER
00801      ;general purpose 1 byte buffer
00802      EXTERN EATBNK
00803      ;bypass leading blanks
00804      EXTERN EATBNK
00805      ;bypass leading non-blank char
00806      ;Model II equates
00807      ;-----
00808      ARROWD EQU 1FH
00809      ;arrow down
00810      ARROWL EQU 1CH
00811      ;arrow left
00812      ARROWR EQU 1DH
00813      ;arrow right
00814      ARROWU EQU 1EH
00815      ;arrow up
00816      BKKEY EQU 3
00817      ;break key
00818      BSKEY EQU 80
00819      ;backspace key
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00821      ;copyright notice position
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00828      LBYTE EQU 800
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00832      SWIDTH EQU 80
00833      ;screen width
00834      SML EQU 79
00835      ;screen width minus 1
00836      TOPLN EQU 19
00837      ;top line of edit text
00838      ;-----
00839      ;MODII I/O parm
00840      ;-----
00841      PUBLIC ARROWD
00842      ;arrow down
00843      PUBLIC ARROWL
00844      ;arrow left
00845      PUBLIC ARROWR
00846      ;arrow right
00847      PUBLIC ARROWU
00848      ;arrow up
00849      PUBLIC BKKEY
00850      ;break key
00851      PUBLIC BSKEY
00852      ;backspace key
00853      PUBLIC CYPPOS
00854      ;copyright notice position
00855      PUBLIC DEKEY
00856      ;delete key
00857      PUBLIC DFTS
00858      ;default file size
00859      PUBLIC INKEY
00860      ;insert key
00861      PUBLIC LBYTE
00862      ;col of last byte in 255 byte rec
00863      PUBLIC PENUL
00864      ;penultimate line (next to bottom)
00865      PUBLIC SWIDTH
00866      ;screen width
00867      PUBLIC SML
00868      ;screen width minus 1
00869      PUBLIC TOPLN
00870      ;top line of editor screen
00871      ;-----
00872      ;external routines and buffers
00873      ;referenced by MODII
00874      ;-----
00875      EXTERN ANSWER
00876      ;general purpose 1 byte buffer
00877      EXTERN EATBNK
00878      ;bypass leading blanks
00879      EXTERN EATBNK
00880      ;bypass leading non-blank char
00881      ;Model II equates
00882      ;-----
00883      ARROWD EQU 1FH
00884      ;arrow down
00885      ARROWL EQU 1CH
00886      ;arrow left
00887      ARROWR EQU 1DH
00888      ;arrow right
00889      ARROWU EQU 1EH
00890      ;arrow up
00891      BKKEY EQU 3
00892      ;break key
00893      BSKEY EQU 80
00894      ;backspace key
00895      CYPPOS EQU 79
00896      ;copyright notice position
00897      DEKEY EQU 19
00898      ;delete key (F2)
00899      DFTS EQU 22
00900      ;default file size for 3bys
00901      INKEY EQU 14
00902      ;insert key (F1)
00903      LBYTE EQU 800
00904      ;col of last byte in 255 byte rec
00905      PENUL EQU 255
00906      ;penultimate line
00907      SWIDTH EQU 80
00908      ;screen width
00909      SML EQU 79
00910      ;screen width minus 1
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00913      ;-----
00914      ;MODII I/O parm
00915      ;-----
00916      PUBLIC ARROWD
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00919      ;arrow left
00920      PUBLIC ARROWR
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00923      ;arrow up
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00953      ;bypass leading blanks
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00955      ;bypass leading non-blank char
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00957      ;-----
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00959      ;arrow down
00960      ARROWL EQU 1CH
00961      ;arrow left
00962      ARROWR EQU 1DH
00963      ;arrow right
00964      ARROWU EQU 1EH
00965      ;arrow up
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00967      ;break key
00968      BSKEY EQU 80
00969      ;backspace key
00970      CYPPOS EQU 79
00971      ;copyright notice position
00972      DEKEY EQU 19
00973      ;delete key (F2)
00974      DFTS EQU 22
00975      ;default file size for 3bys
00976      INKEY EQU 14
00977      ;insert key (F1)
00978      LBYTE EQU 800
00979      ;col of last byte in 255 byte rec
00980      PENUL EQU 255
00981      ;penultimate line
00982      SW
```


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record signature bit equals 1, the screening test is positive, and the program searches the source record for the key. Since it isn't efficient to compare 1 bit at a time on an 8-bit machine, the program processes eight record signatures at once.

To search the file in Fig. 5, you must first open the index file, then the source file specified in the index file header. The search begins when you enter a key (e.g., the name "Jill").

The program hashes each triplet of the key and stores the hash value sequentially in the key hash buffer (Fig. 6). In the example, it stores the hash values 212 (h(jil)) and 142 (h(ill)) respectively in the first and second bytes of the key hash buffer.

Then the program reads the first signature sector of the index file into the signature sector buffer in memory. It sets the accumulator (A) to 255 (1111 1111 binary). The program ANDs byte 212 (hash value of the triplet "jil") of the signature sector with A.

If A equals zero, the triplet "jil" isn't present in the first eight sectors of text and you can process the next signature sector. If A doesn't equal zero, the triplet "jil" might be present, so the program continues to process the current signature sector.

The program ANDs byte 142 (hash value of the triplet "ill") of the signature sector with A. Skip to the next signature sector if A equals zero; otherwise continue as follows. For each bit in A equal to 1 it's possible (but not certain) that the corresponding record contains the triplets "jil" and "ill".

In the example, A equals 72 (0100 1000 binary), indicating that sectors 3 and 6 might contain the key you're looking for. The program reads record 3 into memory and searches sequentially for the string "Jill". It finds the key and displays the record.

Then the program reads record 6 into memory, but the key "Jill" isn't present so it bypasses the record. The reason for the collision is simple—the triplet "goa" hashes to the same value as "jil" and the triplet "ill" appears in both records.

The program sequentially reads the index file a sector at a time and processes each signature sector similarly. After it screens the entire index file and searches the appropriate source records, you can enter another key to restart the searching process.

Searching for the joint occurrence of two or more keys is merely an extension of the above procedure (search the file for the names "Jack" and "Jill"). The

*"The program processes
eight record signatures
at once."*

program stores the hash values (123, 4, 212, and 142) of the triplets "jac", "ack", "jil", and "ill" in the key hash buffer.

The program reads the first signature sector into memory and sets the accumulator to 255. It ANDs byte 123 of the signature sector with A. Similarly, it ANDs bytes 4, 212, and 142 of the signature sector with A.

If at any time A equals zero, none of the eight source records contains both strings, and the search skips to the next signature sector. In the example, only bit 5 equals 1, so it's the only source record searched. The program finds the names "Jack" and "Jill" and displays the record.

In these simple examples only one record is present per sector. When two or more records completely fit into one sector, the program indexes the entire sector as one record. When the program searches the sector, however, it examines each record separately for the search key(s). If a record spans a sector boundary (starts in one sector and ends in another), it is considered as logically in the first sector in which it begins.

You increase the speed of searching by storing as many signature sectors as possible in memory (reducing the number of disk reads during index screening).

TRS-80 Signature Screening

Mindex and Search are Assembly-language programs that use signature screening to search text files. Mindex indexes the source file and stores the index on disk. Search uses the index created by Mindex to search large text files quickly.

These programs were written with the Radio Shack Assembly Language Development System (ALDS) on a Model II. Each program consists of several modules. The two input/output (I/O) modules include MODII/SRC for the Model II and MODIII/SRC for the Model III.

The ALDS editor, assembler, and linker work only on the Model II. If you have a Model III and want to use these programs exactly as written, you must first write, assemble, and link them on a Model II and then, using the ALTRAN

Listing 3 continued

```

00217 BACHS LD A,1 ;(break) pressed on A=1
00218 FCB MC
00219 RET
-----
00220 ;KEMALT
00221 ;
00222 ;wait for char from keyboard
00223 ;corba like Model II KEMALT
00224 KEMALT PUSH BC
00225 LD B,0
00226 LD A,'0'
00227 LD (KEMALT),A ;initializes to on break
00228 KEM4 SVC AF
00229 LD A,(KEM4)
00230 CP '0' ;(break) pressed?
00231 JB S,KEM4 ;if to break purchasing section
00232 POP BP
00233 LD B,KEM4 ;loop until key pressed
00234 LD A,B ;move entered key to A reg
00235 POP BC
00236 RET
00237 KEM4 LD B,0
00238 LD A,1 ;break key entered
00239 POP BC
00240 RET
-----
00241 ;INVTENT
00242 ;
00243 ;word processing KEMALT routine
00244 ;on the Model II this is basically
00245 ;the same as the KEMALT routine
00246
00247 EVCENT PUSH BC
00248 LD B,1
00249 SVC B
00250 LD B,0
00251 RETM4 CALL KEMALT
00252 LD C,A
00253 LD B,2
00254 SVC B
00255 LD A,C
00256 POP BC ;restores keyed in char
00257 RET
-----
00258 ;OPEN
00259 ;
00260 ;open file
00261 ;entry: HL->buffer
00262 ; DS=0000
00263 ;exit: A=TRDLOC error msg
00264 ;reg altered: AF,HL
00265
00266 OPEN LD (NOFADN),HL
00267 LD HL,NOFADN
00268 SVC 00
00269 LD FCB AF
00270 LD A,0
00271 LD (HL),A ;set record length to 256 bytes
00272 LD (HL),A
00273 POP AF
00274 RET
00275
00276 ;
00277 NOFADN DEFW 0 ;buffer address (passed by HL)
00278 NOCADN DEFW 0 ;record address (not needed for 256 byte rec)
00279 NOCADN DEFW 0
00280 ACCESS DEFW '0' ;read only access
00281 EL DEFW 0 ;record length (set to 0)
00282 VORP DEFW '0' ;variable or fixed len record
00283 CREATE DEFW 0
00284 ATTRIB DEFW 0
00285
00286 ;INIT
00287 ;
00288 ;initialize (create) a file
00289 ;entry: HL->record buffer
00290 ; DS=0000
00291 ;exit: A=TRDLOC error msg
00292 ;reg altered: AF,HL
00293
00294 INIT LD (NOFADN),HL
00295 LD HL,NOFADN
00296 SVC 00
00297 LD FCB AF
00298 LD A,0
00299 LD (HL),A ;record length = 256
00300 LD (HL),A
00301 POP AF
00302 RET
00303
00304 NOFADN DEFW 0 ;address of sector buffer
00305 NOCADN DEFW 0 ;address of record buffer
00306 NOCADN DEFW 0
00307 ACCESS DEFW '0' ;access = (W)rite
00308 EL DEFW 0 ;record length = 256 bytes
00309 VORP DEFW '0' ;fixed length records
00310 CREATE DEFW 0
00311 ATTRIB DEFW 0
00312
00313 ;CLOSE
00314 ;
00315 ;reopen a file but do not reset it
00316 ;entry: HL->sector rbuf buffer
00317 ; DS=0000
00318 ;exit: A=TRDLOC error msg
00319 ;reg altered: AF,DL,HL
00320
00321 UNINIT LD A,0
00322 LD (CREATE),A ;open only do not reset
00323 LD NOCADN DEFW 0 ;record buffer
00324 LD (NOFADN),HL ;sector buffer address
00325 LD HL,NOFADN
00326 LD FCB AF
00327 LD A,(ANSWER)
00328 CP '0'
00329 JB S,UNINIT
00330 SVC 40 ;open
00331 LD A,0
00332 LD (CREATE),A ;create and reset
00333 LD HL,NOFADN
00334 LD FCB AF
00335 LD A,0
00336 LD (HL),A ;open
00337 LD (HL),A
00338 POP BC
00339 LD A,0 ;restore stack
00340 LD (HL),A
00341 RET
00342
00343 NOFADN DEFW 0
00344 NOCADN DEFW 0
00345 NOCADN DEFW 0
00346 ACCESS DEFW '0'
00347 EL DEFW 0
00348 VORP DEFW '0'
00349 CREATE DEFW 0
00350 ATTRIB DEFW 0
00351
00352 ;CLOSE
00353 ;
00354 ;close file
00355 ;entry: DS=0000
00356 ;exit: A=TRDLOC error msg
00357 ;close file
00358
00359 CLOSE SVC 42
00360 RET
00361
00362 ;SETUP
00363 ;
00364 ;set RAZ last record to know last row
00365 ;this routine is necessary to make progress
00366 ;compatible with Model III
00367
00368 SETUP LD (NOFADN),HL
00369 LD (RAZ),HL ;do need to dup HL on Mod II
00370 RET

```

Listing 3 continued

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programs supplied in the ALDS package, transfer them to the Model III.

Alternatively, you can write and assemble the programs using a simple editor/assembler such as Radio Shack's Series I Editor/Assembler (EDTASM). EDTASM does not contain a linker so it's necessary to combine the modules into one program for Mindex and Search.

I first developed Mindex and Search (version 1.1) on a Model III using EDTASM. However, the editor's memory was limited and the program comments were restricted.

When I switched to the Model II, I started using ALDS. Much to my chagrin, the operating systems of the two machines are quite different. For exam-

ple, to display a character on the Model III, you load the character into the accumulator and make a call to location 33 hexadecimal (hex). The routine alters the contents of the DE register pair.

On the Model II, you load the character into register B, load the supervisor call code 8 into the accumulator, and execute an RST 8 operation. The DE register pair isn't altered.

Rather than rewrite the program for the Model II, I developed separate I/O routines for the Models II and III. Since I wrote the original programs for the Model III, the parameters pass to the I/O routines in Model III format.

For example, the program stores the character you want displayed on the screen in the accumulator. A few of the

Model II routines (SVCs) aren't present in Model III TRSDOS so I added them (such as routines to position the cursor at coordinates stored in the BC register pair).

If you're using Radio Shack's ALDS, type in the program modules in Program Listings 1-3 and 7-12 for the Model II, and Listings 4-12 for the Model III. After the ALDS writes each module, you must assemble them to relocatable code by using ALASM, the ALDS assembler.

After ALASM assembles all modules, you're ready to link them. For the Model II, type ALLINK MINDEX2 MINDEX \$=4000 to link the Mindex program and ALLINK SEARCH2 SEARCH \$=4000 to link the Search

Listing 3 continued

```

00301  SETILR          ;SETILR
00302  ;-----
00303  ;set input last rec to true last rec
00304  SETILR LD      HL,(IDCBLR)
00305  LD          (INLRL),HL
00306  ;true value regardless of whether
00307  ;vector is full or not!!
00308  RET
00309  ;-----
00310  ;POSH
00311  ;not used for Model II
00312  ;but present for Mod III compatibility
00313  POSH          RET
00314  ;-----
00315  ;POSBOP
00316  ;position to end of file
00317  ;entry: DE->DCB
00318  POSBOP LD      BC,$FFFF
00319  SVC        35
00320  ;-----
00321  ;LOCATE
00322  ;must have thiat
00323  ;sets file cursor to last char
00324  LOCATE LD      DE,OUTDCB
00325  SVC        33
00326  LD          DE,OUTDCB
00327  SVC        35
00328  RET
00329  ;-----
00330  ;READDR
00331  ;read direct
00332  ;entry: DE->DCB,BC=rec no.
00333  READDR SVC     35
00334  RET
00335  ;-----
00336  ;READNR
00337  ;read next record
00338  ;entry: DE->DCB
00339  READNR SVC     34
00340  RET
00341  ;-----
00342  ;WRITE
00343  ;write direct
00344  ;entry: DE->DCB,BC=rec no.
00345  WRITE SVC      44
00346  RET
00347  ;-----
00348  ;WRITNR
00349  ;write next record
00350  ;entry: DE->DCB
00351  WRITNR SVC     43
00352  RET
00353  ;-----
00354  ;RLINE and RLIN3
00355  ;RLINE: EOR=00H, RLIN3: EOR=1
00356  ;entry: HL->buf
00357  ;B = max length
00358  ;EOR=00H or 01
00359  ;returns with last char entered in A
00360  ;EOR=1
00361  RLINE LD      A,J
00362  JR          KBL3
00363  RLINE LD      A,$0H
00364  RLINE LD      (EORCH),A
00365  RLINE LD      A,1
00366  CALL      VDCB
00367  LD          C,B
00368  CALL      KBL5
00369  LD          D,A
00370  CP          00H
00371  JZ          KBL3
00372  JR          KBL5
00373  CP          00H
00374  JZ          KBL5
00375  JR          KBL5
00376  CP          00H
00377  JZ          KBL5
00378  JR          KBL5
00379  CP          00H
00380  JZ          KBL5
00381  JR          KBL5
00382  CP          00H
00383  JZ          KBL5
00384  JR          KBL5
00385  CP          00H
00386  JZ          KBL5
00387  JR          KBL5
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01202  JZ          KBL5
01203  JR          KBL5
01204  CP          00H
01205  JZ          KBL5
01206  JR          KBL5

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File Name:

Enter name of file to be indexed, or ? for help

Figure 7. The Mindex screen.

program. Do the same for the Model III, but use the file names MINDEX3 and SEARCH3 and set \$=5200 (the program's starting location).

To transfer the programs from the Model II to a Model III, you must use the ALTRAN transfer programs supplied with ALDS. On the Model III, Mindex and Search must have the ex-

tension CMD; on the Model II, no extension is necessary.

Using Mindex and Search

After you assemble and link both programs, you're ready to begin indexing and searching. The first requirement is an ASCII text file. You can create the text with Scripsit and convert it to

ASCII file format by using the Scripsit convert utility.

If you don't have Scripsit or some other word processor/text editor, you can create text files by using the editor that comes with Basic. Instead of typing in a line of code, type in a record. You must save text files created with the Basic editor in ASCII format.

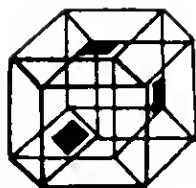
Mindex indexes text or data source files. It stores the index in the separate MAP index file. The program segments records longer than 255 characters into blocks of 255 characters and indexes them until it finds a block of characters less than 255 characters long terminating in an end-of-record (EOR) message. The index file that Mindex creates has the same name as your source file (unless you specify otherwise) and the extension MAP.

To run Mindex, type MINDEX and press the enter key. Mindex displays the screen in Fig. 7 and waits for you to enter the file specifications of the source and index files. The syntax is: SOURCE

Listing 3 continued

```

00572      routine to input search keys
00573      entry: HL -> input buffer
00574      R = new no. of char
00575      entry: HL -> ROR
00576      B=no. char, A= EOR
00577      KEYIN LD A,1
00578      CALL VOCHAR
00579      LD A,17
00580      CALL VOCHAR
00581      LD C,8
00582      GETCHR NOP
00583      CALL EBNRT
00584      CP 1
00585      JP 1,RYARD
00586      CP 2
00587      JP 2,RYARD
00588      CP 3
00589      JP 3,RYARD
00590      CP 4
00591      JP 4,RYARD
00592      CP 5
00593      JP 5,RYARD
00594      CP 6
00595      JP 6,RYARD
00596      CP 7
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01435      JP 426,RYARD
01436      CP 427
01437      JP 427,RY
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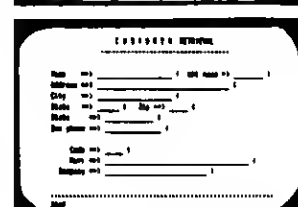
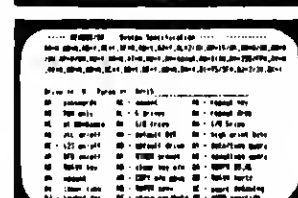
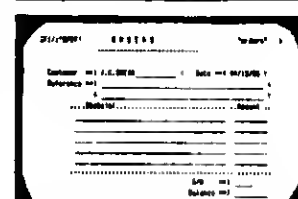
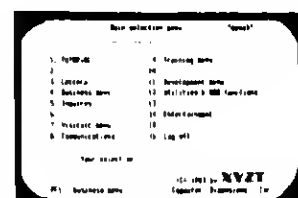
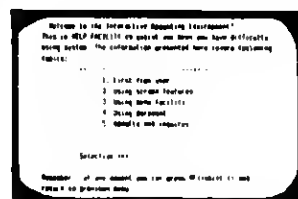
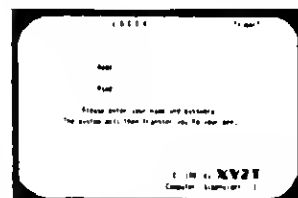
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File Name:

Enter file names, or ? for help

Figure 8. Initial Search screen.

FILE, INDEX FILE, OPTIONS.

You can also enter the file specifications and options on the TRSDOS command line (MINDEX REF:0,:1;P). Only the source file specification is necessary; the program assigns the index file the same name, password, and disk drive as the source file unless you specify otherwise.

For example, typing REF/TXT.SECRET:1 and pressing the enter key opens the source file "REF/TXT.SECRET:1" and creates the index file "REF/MAP.SECRET:1", while typing REF/TXT.SECRET:1,.CODEWORD:2 and pressing the enter key opens the source file "FILE1/TXT.SECRET:1" and creates the index file "FILE1/MAP.CODEWORD:2".

In this case the index file has a different password from the source file and is on drive 2 rather than drive 1. You don't need to specify the disk drive for your source file unless you have two files with the same specification on two separate drives. The program places the index file on the same disk as the source file unless you specify another drive.

Indicate the paragraph format option by appending a semicolon and the letter P to the file specifications. In the paragraph format, the program treats each sentence as a string. You should use the paragraph format for text files composed of sentences arranged in paragraphs and that don't have an EOR at the end of each line or sentence.

MAP uses the period as a pseudo EOR and treats each sentence as a record. If you don't specify the indexing format, the program defaults to the record format. Typing TEXTFILE,:1;P and pressing the enter key opens the source file TEXTFILE from whatever drive it's on, creates the index file TEXTFILE/MAP on drive 1, and indexes the source file in paragraph format.

Minindex displays the name, extension, password, and drive of the source and

data files, indicates that it's opened each file successfully (or gives a self-explanatory error message), and begins indexing. The program displays the number of the source file sector it indexes.

When the program finishes indexing, it saves the index file on disk and returns you to TRSDOS. You don't need to re-index the source file unless you modify the file or you delete the index file from the disk.

To run Search, type SEARCH and press the enter key. The screen in Fig. 8 appears. Type in the name of the file you want to search. Alternatively, you can enter the file specifications on the TRSDOS command line (SEARCH REF:1). The complete syntax is SOURCE FILE, INDEX FILE, OUTPUT FILE.

It's only necessary to type in the name of the source file. The program assigns the same specification to the index file (except for the extension MAP) and output file (except for the extension OUT) unless you specify otherwise.

For example, typing TESTFILE/TXT assigns the specification TESTFILE/MAP to the index file and TESTFILE/OUT to the output file. The MAP index file contains the source file name, extension, and password so you don't have to type in that information.

The appropriate files will open, the index will load into memory, and you can begin your search. If an error occurs in opening the files, the program informs you of the type of error so you can correct it.

After Search opens the MAP index file and its associated source file, the name of the source file appears at the top of the screen. The blinking cursor on the second line under the letter E is a prompt for you to enter the key or keys you want to locate. Type the key(s) you're searching for and tap the enter key.

Each key must be three or more char-

```

08747  LD      R,PERULM
08748  LD      C,8
08749  CALL    POSCUR      ;reposition cursor to next to last line
08750  POP     HL
08751  POP     DE
08752  POP     BC
08753  RET
08754  ;-----
08755  ;PTRREC
08756  LD      C,8
08757  LD      A,(HORIUM)
08758  CP      4
08759  JP      3,PTR2
08760  LD      A,(HORIUM)
08761  DEC     A
08762  LD      B,A
08763  LD      HL,PTRUP
08764  LD      C,8
08765  LD      B,A
08766  LD      HL,PTRUP
08767  LD      C,8
08768  LD      B,A
08769  LD      HL,PTRUP
08770  LD      C,8
08771  LD      B,A
08772  LD      HL,PTRUP
08773  LD      C,8
08774  LD      B,A
08775  LD      HL,PTRUP
08776  LD      C,8
08777  LD      B,A
08778  LD      HL,PTRUP
08779  LD      C,8
08780  LD      B,A
08781  LD      HL,PTRUP
08782  LD      C,8
08783  LD      B,A
08784  LD      HL,PTRUP
08785  LD      C,8
08786  LD      B,A
08787  LD      HL,PTRUP
08788  LD      C,8
08789  LD      B,A
08790  LD      HL,PTRUP
08791  LD      C,8
08792  LD      B,A
08793  LD      HL,PTRUP
08794  LD      C,8
08795  LD      B,A
08796  LD      HL,PTRUP
08797  LD      C,8
08798  LD      B,A
08799  LD      HL,PTRUP
08800  LD      C,8
08801  LD      B,A
08802  LD      HL,PTRUP
08803  LD      C,8
08804  LD      B,A
08805  LD      HL,PTRUP
08806  LD      C,8
08807  LD      B,A
08808  LD      HL,PTRUP
08809  LD      C,8
08810  LD      B,A
08811  LD      HL,PTRUP
08812  LD      C,8
08813  LD      B,A
08814  LD      HL,PTRUP
08815  LD      C,8
08816  LD      B,A
08817  LD      HL,PTRUP
08818  LD      C,8
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08821  LD      C,8
08822  LD      B,A
08823  LD      HL,PTRUP
08824  LD      C,8
08825  LD      B,A
08826  LD      HL,PTRUP
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08829  LD      HL,PTRUP
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08831  LD      B,A
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08835  LD      HL,PTRUP
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08838  LD      HL,PTRUP
08839  LD      C,8
08840  LD      B,A
08841  LD      HL,PTRUP
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08843  LD      B,A
08844  LD      HL,PTRUP
08845  LD      C,8
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08847  LD      HL,PTRUP
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08871  LD      HL,PTRUP
08872  LD      C,8
08873  LD      B,A
08874  LD      HL,PTRUP
08875  LD      C,8
08876  LD      B,A
08877  LD      HL,PTRUP
08878  LD      C,8
08879  LD      B,A
08880  LD      HL,PTRUP
08881  LD      C,8
08882  LD      B,A
08883  LD      HL,PTRUP
08884  LD      C,8
08885  LD      B,A
08886  LD      HL,PTRUP
08887  LD      C,8
08888  LD      B,A
08889  LD      HL,PTRUP
08890  LD      C,8
08891  LD      B,A
08892  LD      HL,PTRUP
08893  LD      C,8
08894  LD      B,A
08895  LD      HL,PTRUP

```

Listing 3 continued

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acters long, and no key or combination of keys can be longer than 60 characters. Search ignores capitalized letters and lets you search for partial keys. For example, the key "cdonal" locates records containing the names McDonald and MacDonald.

You can search for combinations of keys within records or sentences. You find combinations by using the logical operators AND or OR. AND is represented by the + symbol (hold the shift key and press +). OR is represented by the | symbol (hold the control key and press zero on the Model II; hold the shift key and press @ on the Model III).

On the Model II the operators + and | appear in inverse video to distinguish them from characters in a key. On the Model III a small, solid white rectangle appears under the operator to indicate that it isn't a character in a key. For example, the search key Jack + Jill|Jack +

"You can search for combinations of keys within records or sentences."

nimble finds records that contain the names Jack and Jill or records containing the name Jack and the word nimble.

On the Model II, enter the + character as part of a key by pressing F1 and enter the | character as part of a key by pressing F2. On the Model III the @ key enters special characters from the keyboard.

If the key you're searching for has the symbol + or |, you can enter it in the following manner: press the @ key (unshifted) and the cursor becomes larger. Then enter either + or |. You enter

the @ character into a key in the same manner.

After you enter a valid key, the program starts its search and the message "Searching" appears in the upper left corner of the screen. The number of each sector searched appears next to the word Searching.

When the program locates the first record in the file with the appropriate key (or keys), it displays the record at the bottom of the screen. One record appears at a time and the program waits for your instructions to continue the search, abort the search, or display text around the located record.

To continue the search, press the down-arrow key after each line of text appears. Pressing and holding the down-arrow key (and the repeat key on the Model II) lets you continuously scroll through records as the program finds them. When the program has

Listing 3 continued

```
00000  NDCHCR  DEFS  0      ;current record
00001  DEFS  0
00002  DEFS  0
00003  NDCHLR  DEFS  0      ;last record
00004  DEFS  0
00005  NDCHOS  DEFS  0
00006  DEFS  58
00007  NAPLIR  DEFS  0      ;true last sector
00008  DEFS  0
00009  OUTOCR  DEFS  66      ;output file DCR
00010  DEFS  0
00011  AORLIR  DEFS  0      ;start of record line number
00012  DEFS  0      ;for each line of rec displayed
00013  ;(AORLIR) is decremented
00014  STNAP  DEFS  0
00015  END
```

Program Listing 6. Assembly-language listing of MODIII/SRC.

```
Ln #      Source Line
00001  ;MODIII/SRC  VERSION 1.2
00002  ;Jun 26, 1983
00003  ;-----
00004  ;MAP MODEL III I/O ROUTINES, BUFFERS AND PARAMETERS
00005  ;COPYRIGHT 1983, SOFTWARE CORPORATION ALL RIGHTS RESERVED
00006  ;-----
00007  MODIII  PSECT      ;begin relocatable program section
00008  ;-----
00009  ;-----
00010  ;public routines
00011  ;-----
00012  PUBLIC  BOTTOM      ;position cursor to last line of screen
00013  PUBLIC  CLOS      ;close file (DCR)
00014  PUBLIC  CURPOS      ;determine cursor pos (COORD)
00015  PUBLIC  DIBR      ;display break (for Model II)
00016  PUBLIC  DIVIDE      ;divide A into BL
00017  PUBLIC  DORCHD      ;rip to TRODCH and execute command
00018  PUBLIC  ERASEL      ;erase to end of line
00019  PUBLIC  ERASEB      ;erase to end of screen
00020  PUBLIC  ERSEP      ;MAP error display routine
00021  PUBLIC  HERR      ;position cursor to top line of screen
00022  PUBLIC  INIT      ;initialize file (create/open, pos to 1st rec)
00023  ; (DE->DCR, BL->rec buf)
00024  PUBLIC  JFDOE      ;rip to TRODCH
00025  PUBLIC  KCHRA      ;initialize keyboard (Mod II)
00026  PUBLIC  KLRIT      ;get line from keyboard and end with R1
00027  PUBLIC  KLRIR      ;get line from keyboard and end with PM
00028  PUBLIC  KLRIT      ;wait for char from keyboard
00029  PUBLIC  KLRIR      ;get search key(s) from keyboard
00030  PUBLIC  NOVLM      ;move line from screen to buffer
00031  ;BL->buf, D=>no. char, BC=>cursor count
00032  PUBLIC  RULZ      ;multiply routine
00033  PUBLIC  RULM      ;rotate screen and pos cur to next to last line
00034  PUBLIC  OPEN      ;open file (DE->DCR, BL->record buffer)
00035  PUBLIC  OFIRIT      ;open and initialize file
00036  ; (DE->DCR, BL->record buffer)
00037  PUBLIC  POSCUR      ;position cursor (coordinates in RC)
00038  PUBLIC  POSR      ;position to end of file
00039  PUBLIC  POSR      ;position to record in file
00040  PUBLIC  PRINT      ;initialize printer
00041  PUBLIC  PRILIR      ;print line (BL->buf, D=>no. char, C=>end char)
00042  PUBLIC  PRNCR      ;print entire screen
00043  PUBLIC  PRNCR      ;print last line of text
00044  PUBLIC  PRNCR      ;print current record
00045  PUBLIC  PRNCR      ;point to file spec in cmd line
00046  PUBLIC  READR      ;read file direct access
00047  PUBLIC  READR      ;read next record in file
00048  PUBLIC  RECPRO      ;read scroll protect line (A=>line no.)
00049  PUBLIC  RETLIR      ;set TRODCH to true last record
00050  PUBLIC  RETLIR      ;set NAPLIR to true last record
00051  PUBLIC  STREND      ;store top of memory in MEMEND
00052  PUBLIC  VDCNAB      ;display char in A register
00053  PUBLIC  VDCNAB      ;clear screen
00054  PUBLIC  VDIRIT      ;initialize video I/O (for Model II)
00055  PUBLIC  VOLIR      ;display line (BL->msg; don't print ROW)
00056  PUBLIC  VOLIR      ;display line (BL->msg)
00057  PUBLIC  WPMIR      ;word processor input routine
00058  PUBLIC  WRITR      ;direct write routine
00059  PUBLIC  WRITR      ;write next record to file
00060  ;-----
00061  ;MODIII buffers
00062  ;-----
00063  PUBLIC  ACCESS      ;dummy for MODII compatibility
00064  PUBLIC  INDCR      ;input (source) file DCR
00065  PUBLIC  INDCR      ;input file DCR Record Length
00066  PUBLIC  INDCR      ;input file DCR Current Record
00067  PUBLIC  INDCR      ;input file DCR Last Record
00068  PUBLIC  INDCR      ;true last record of source file
00069  PUBLIC  INDCR      ;input file DCR address
00070  PUBLIC  INDCR      ;MAP (index) file DCR
00071  PUBLIC  INDCR      ;map file DCR Record Length
00072  PUBLIC  INDCR      ;map file DCR Current Record
00073  PUBLIC  INDCR      ;map file DCR Last Record
00074  PUBLIC  INDCR      ;true last record of index file
00075  PUBLIC  INDCR      ;map file DCR xxxxxxx
00076  PUBLIC  INDCR      ;contents -> top of memory
00077  PUBLIC  OUTCR      ;recorded buffer (1 byte) for output file
00078  PUBLIC  OUTCR      ;output file DCR
00079  PUBLIC  PRNCR      ;printer buffer (80 char)
00080  PUBLIC  RORLIR      ;start of record line no.
00081  PUBLIC  STNAP      ;start of MAP index file (always last byte
00082  ;of SEARCH program)
00083  ;-----
00084  ;MODIII I/O ports
00085  ;-----
00086  PUBLIC  AAROW      ;arrow down
00087  PUBLIC  ARROWL      ;arrow left
00088  PUBLIC  ARROWR      ;arrow right
00089  PUBLIC  ARROWU      ;arrow up
```

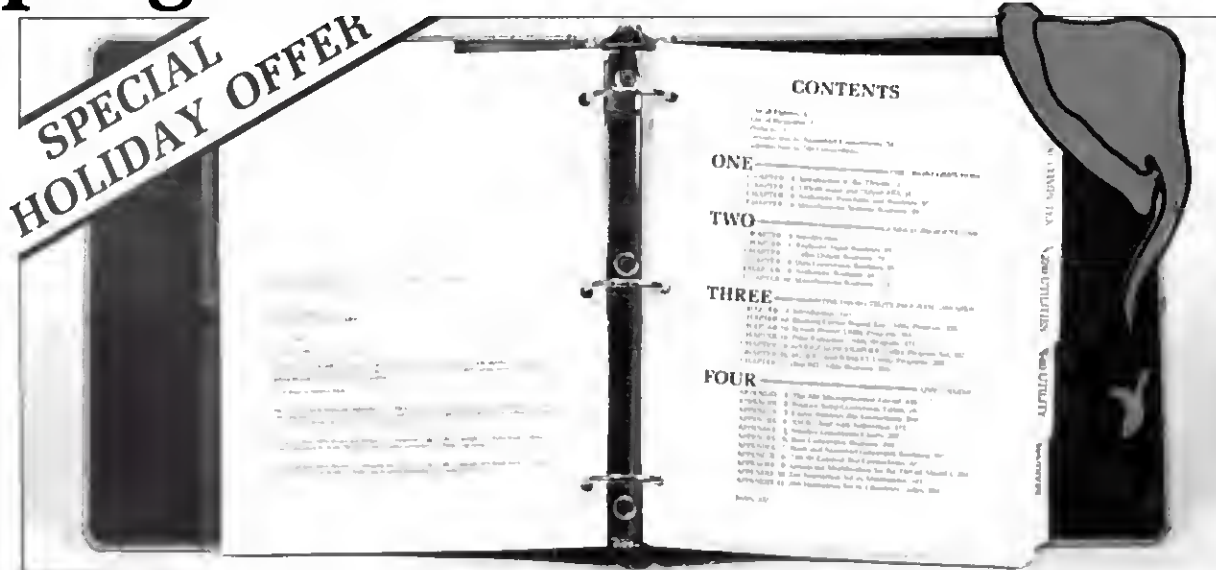
Listing 6 continued

Program Listing 4. Assembly-language listing of Mindex3/SRC.

```
Ln #      Source Line
00001  ;MINDX3/SRC...1.2
00002  ;Mar 25, 1983
00003  ;-----
00004  ;INDEXING PROGRAM FOR MODEL III
00005  ;MASTER SECTION: links main program with Model III I/O routines
00006  ;and general purpose routines
00007  ;COPYRIGHT 1983, SOFTWARE CORPORATION ALL RIGHTS RESERVED
00008  ;-----
00009  MODIII  PSECT      ;begin relocatable program section
00010  ;-----
00011  ;-----
00012  EXTEND  BRCIR      ;BRCIR = start of B3
00013  ;-----
00014  START  JP  BRCIR
00015  LINK  'B3/REL'
00016  ;note: the program is called B3 because it
00017  ;was originally developed on Model III
00018  ;in its current form it will work with
00019  ;Model II or III given the proper I/O
00020  ;module
00021  ;general program
00022  ;Model III I/O routines
00023  ;-----
00024  LINK  'GR/REL'
00025  LINK  'B3OPR/REL'
00026  LINK  'B3OPR/REL'
00027  LINK  'B3OPR/REL'
00028  LINK  'B3OPR/REL'
00029  END  START
```

Program Listing 5. Assembly-language listing of Search3/SRC.1.

Every Z80 assembly-language programmer needs this book.



Programming in assembly language requires good tools. TRS-80/Z80 Assembly Language Library, a complete reference book on TRS-80 Model I assembly language, is the best tool you can find. In over 300-pages, 45 figures, and 75 program listings, author Craig A. Lindley explains the details of Model I hardware and software and shows you how to write programs that squeeze every bit of performance out of your computer. This book will teach you:

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- how to access the video display and keyboard
- how to write easy-to-use programs
- how to perform arithmetic operations
- how to use the undocumented Z80 instructions

You'll also learn about disk operating systems, device handling, base conversion, parameter passing, and more.

TRS-80/Z80 Assembly Language Library contains a library of ready-to-run utility programs that are worth many times the book's cost. Included with the book are two Model I TRSDOS-compatible disks* containing utilities for printer formatting and spooling, single-key entry of strings, disk editing, base conversion, password encoding and decoding, and more. You get more than 15 valuable utilities, and the source code files are included, so you can examine, modify, and learn from every program.

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(C)hange File, (M)AP, (O)ptions or (T)RSDOS

```

xxxxxxx Format
Inset from Left Margin:      x
Search Display Mode: (C/R/L) x
Print Mode: (C/M)           x
Output File Name:            xxxxxxx/OUT
Output File Status: (C/R/A)  x
Output Mode: (C/M)          x

```

Figure 9. Search options screen.

searched the entire file, the message "Enter Key" appears again. You can now search for another key or combination of keys.

Search Options and Commands

While the "Enter Key" message is present and the cursor is in column 1,

you can jump to the Search minimenu by pressing the break key. The following message appears on the top line: "(C)hange File, (M)AP, (O)ptions or (T)RSDOS".

Typing O gives you the Options screen shown in Fig. 9. You can bypass any question in the options menu by

pressing the enter key. The program displays the meaning of abbreviations used in the current prompt at the bottom of the screen.

The first line informs you of the format used to index the file and you can't change it while searching a file.

The inset number (X) ranges from zero to 9. Insetting is similar to indenting except that the first line of a record is flush with the left margin, and subsequent lines are inset from the left margin. The number displayed across from the word inset is the value currently used to inset records. You can change it by typing any number from zero to nine and then pressing the enter key. The default inset is two.

While searching for a key or combination of keys, you can display the information continuously, or a record or line at a time. Type C and press the enter key to have records continuously displayed as the program finds them. Type R and press the enter key for

Listing 6 continued

```

00090 PUBLIC BREAKY      ;break key
00091 PUBLIC SPACEY      ;back space key
00092 PUBLIC CPTPOS      ;copyright msg position
00093 PUBLIC DELKEY       ;delete key
00094 PUBLIC DFTPS        ;default file size
00095 PUBLIC INKEY        ;insert key
00096 PUBLIC LBYTTE       ;col of last byte in 255 byte rec
00097 PUBLIC PENULT        ;penultimate line (next to bottom)
00098 PUBLIC SWIDTH        ;screen width
00099 PUBLIC SML          ;screen width minus 1
00100 PUBLIC TOPLN        ;top line of editor screen
00101
00102
00103 ;external routines and buffers
00104 ;referenced by MODII
00105
00106 EXTERN ADRBUF         ;general purpose 1 byte buffer
00107 EXTERN ADRPND         ;append one string to another
00108 EXTERN ADRBLK         ;bypass leading blanks
00109 EXTERN ADRBLK         ;bypass leading non-blank char
00110
00111 ;Model fill equates
00112
00113 ARROWD EQU 00000000    ;arrow down
00114 ARROWL EQU 00000000    ;arrow left
00115 ARROWR EQU 00000000    ;arrow right
00116 ARROWU EQU 00000000    ;arrow up
00117 BRKKEY EQU 1          ;BREAK
00118 SWIDTH EQU 80          ;screen width
00119 SML EQU 77             ;screen width minus 1
00120 TOPLN EQU 11           ;top line of edit display
00121 LBYTTE EQU 82          ;last col of record byte 255
00122 PENULT EQU 16          ;penultimate line (next to last line)
00123 DFTPS EQU 4            ;default 3845 data file size
00124 DELKEY EQU 4           ;delete key (shift, down arrow, D)
00125 INKEY EQU 17H         ;insert key (CLEAR)
00126 BKPRY EQU 2           ;backspace key (shift, down arrow, B)
00127 CPTPOS EQU 36         ;tab pos for copyright notice
00128
00129 IPRKEY EQU 00000000    ;IPRKEY
00130 FICELA EQU 00000000    ;FICELA
00131 VDCRAB EQU 00000000    ;VDCRAB
00132 VDCLE EQU 00000000    ;VDCLE
00133 INITIO EQU 00000000    ;INITIO
00134 PRCHRG EQU 00000000    ;PRCHRG
00135 PRISCR EQU 00000000    ;PRISCR
00136 DIRTY EQU 00000000    ;DIRTY
00137 DOPER EQU 00000000    ;DOPER
00138 DPCOR EQU 00000000    ;DPCOR
00139 DEARQ EQU 00000000    ;DEARQ
00140 DWRITE EQU 00000000    ;DWRITE
00141 DWRPC EQU 00000000    ;DWRPC
00142 DPCOR EQU 00000000    ;DPCOR
00143 DCLDSE EQU 00000000    ;DCLDSE
00144 JFZDOS EQU 00000000    ;JFZDOS
00145 CORDOS EQU 00000000    ;CORDOS
00146 CROTAT EQU 00000000    ;CROTAT
00147
00148 DELAY EQU 00000000     ;DELAY
00149 CURSOR EQU 00000000    ;CURSOR
00150 CURSOR EQU 00000000    ;CURSOR
00151 CURSOR EQU 00000000    ;CURSOR
00152 VIDEO EQU 00000000    ;VIDEO
00153 DCRPPE EQU 00000000    ;DCRPPE
00154 DCRPPE EQU 00000000    ;DCRPPE
00155 DIVIDE EQU 00000000    ;DIVIDE
00156 DRULT EQU 00000000     ;DRULT
00157 ROMEN EQU 00000000     ;ROMEN
00158
00159 ;=====
00160 ;=====
00161 ;=====
00162 ;=====
00163 ;=====
00164 ;=====
00165 ;=====
00166 ;=====
00167 ;=====
00168 ;=====
00169 ;=====
00170 ;=====
00171 ;=====
00172 ;=====
00173 ;=====
00174 ;=====
00175 ;=====
00176 ;=====

```

```

00177 PUBLIC DE            ;cursor to next to last line
00178 PUBLIC BL            ;position to bottom line
00179 CALL A,DE             ;position to bottom line
00180 LD A,DE               ;roll screen
00181 CALL VDCRAB           ;roll screen
00182 LD A,DE               ;roll screen
00183 CALL POSCUR           ;position to next to last line
00184 LD A,(BOLRN)          ;has first line reached top of screen?
00185 CP 0                  ;if it has B0 not dec (BOLRN)
00186 JP B,BOLRN            ;dec (BOLRN)
00187 LD A,(BOLRN)          ;dec (BOLRN)
00188 DBC A                 ;dec (BOLRN)
00189
00190 WDRMNS POP HL         ;=====
00191 POP DE               ;=====
00192 POP BC               ;=====
00193 RET                  ;=====
00194
00195 ;=====
00196 ;=====
00197 ;=====
00198 ;=====
00199 ;=====
00200 CURPOS POP HL        ;=====
00201 POP DE               ;=====
00202 LD HL,A              ;=====
00203 LD HL,(CURPOS)       ;=====
00204 LD DE,VIDBO          ;=====
00205 DB A                 ;=====
00206 SBC HL,DE            ;=====
00207 JP S,CURS            ;=====
00208 CURLF POP HL         ;=====
00209 LD DE,64              ;=====
00210 DB A                 ;=====
00211 SBC HL,DE            ;=====
00212 JP S,CURS            ;=====
00213 LD HL,CURS           ;=====
00214 INC HL               ;=====
00215 POP DE               ;=====
00216 JP CURLF            ;=====
00217 CURS POP DE          ;=====
00218 INC DE               ;=====
00219 JP CURS              ;=====
00220 CURK POP HL          ;=====
00221 LD C,L               ;=====
00222 CURA POP HL          ;=====
00223 POP DE               ;=====
00224 POP BC               ;=====
00225 POP HL               ;=====
00226 RET                  ;=====
00227
00228 ;=====
00229 ;=====
00230 ;=====
00231 ;=====
00232 ;=====
00233 POSCUR POP HL        ;=====
00234 POP DE               ;=====
00235 LD A,15              ;=====
00236 CP 0                  ;=====
00237 JP C,POS             ;=====
00238 LD A,63              ;=====
00239 LD C,POS             ;=====
00240 LD HL,VIDBO          ;=====
00241 LD A,64              ;=====
00242 LD HL,VIDBO          ;=====
00243 LD HL,VIDBO          ;=====
00244 LD HL,VIDBO          ;=====
00245 LD HL,VIDBO          ;=====
00246 LD HL,VIDBO          ;=====
00247 LD HL,VIDBO          ;=====
00248 LD HL,VIDBO          ;=====
00249 LD HL,VIDBO          ;=====
00250 LD HL,VIDBO          ;=====
00251 LD HL,VIDBO          ;=====
00252 LD HL,VIDBO          ;=====
00253 LD HL,VIDBO          ;=====
00254 LD HL,VIDBO          ;=====
00255 LD HL,VIDBO          ;=====
00256 LD HL,VIDBO          ;=====
00257 LD HL,VIDBO          ;=====
00258 LD HL,VIDBO          ;=====
00259 LD HL,VIDBO          ;=====
00260 LD HL,VIDBO          ;=====
00261 LD HL,VIDBO          ;=====
00262 LD HL,VIDBO          ;=====
00263 LD HL,VIDBO          ;=====
00264 LD HL,VIDBO          ;=====

```

Listing 6 continued

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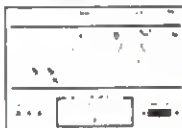
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Listing 6 continued

```

00265 ;exit: A=TRSDOS error code
00266 OPEN CALL DOPEN
00267 PUSH AP
00268 LD A,0
00269 LD (IDCBRL),A ;RL=356
00270 LD A,32
00271 LD (IDCBH),A ;RL=35627
00272 POP AP
00273 RET
00274
00275 ;INIT
00276 ;initialize file
00277 ;DE->DCB
00278 INIT CALL DINIT
00279 RET
00280
00281 ;OPINIT
00282 ;open file if present, else init file
00283 ;entry: RL->buffer
00284 ; DE->DCB
00285 ;exit: A=TRSDOS error code
00286 OPINIT PUSH BC
00287 PUSH DE
00288 PUSH HL
00289 CALL DOPEN
00290 ;try to open file first
00291 ;keeps present record no.
00292 JP Z,OPIT4
00293 POP HL
00294 POP DE
00295 POP BC
00296 CALL DINIT
00297 ;sets last rec no. = 0
00298 OPIT4 POP HL
00299 POP DE
00300 POP BC
00301 RET
00302 ;open attempt successful
00303 OUTCHR DEFB 0 ;output record buffer for Mod II
00304 ;CLOSE
00305 ;close file
00306 ;entry: DE->DBC
00307 CLOSER CALL DCLOSE
00308 RET
00309
00310 ;SETMLR
00311 ;set MAPLR to true last rec
00312 ;MODIII adjustment
00313 SETMLR LD HL,(IDCBRL)
00314 LD HL,(IDCBOS)
00315 LD HL,(MAPLR),HL
00316 LD HL,(MAPLR),HL
00317 RET
00318
00319 ;SETILR
00320 ;set INILR to true last record
00321 SETILR LD HL,(IDCBRL)
00322 LD HL,(IDCBOS)
00323 LD HL,(INILR),HL
00324 LD HL,(INILR),HL
00325 LD HL,(INILR),HL
00326 LD HL,(INILR),HL
00327 LD HL,(INILR),HL
00328 LD HL,(INILR),HL
00329 LD HL,(INILR),HL
00330 LD HL,(INILR),HL
00331 LD HL,(INILR),HL
00332 LD HL,(INILR),HL
00333 LD HL,(INILR),HL
00334 LD HL,(INILR),HL

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00335 ;position to rec in file
00336 ;entry: DE->DCB
00337 ; BC=rec no.
00338 ;exit: A=TRSDOS error code
00339 POSM CALL DPOSM
00340 RET
00341
00342 ;POSEOF
00343 ;position to end of file
00344 ;entry: DE->DCB
00345 ;exit: TRSDOS error code
00346 POSEOF CALL DPOSEOF
00347 CALL DREAD
00348 RET
00349
00350 ;READDR
00351 ;direct read
00352 ;entry: DE->DCB
00353 ; BC=rec. no.
00354 ;exit: A=TRSDOS error msg
00355 READDR PUSH BC
00356 CALL DPOSM
00357 CALL DREAD
00358 CALL DREAD
00359 CALL DREAD
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00361 CALL DREAD
00362 CALL DREAD
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Listing 6 continued

COOSOL COMPUTER PRODUCTS

COLUMBIA DATA MPC



- COLUMBIA System Includes: IBM COMPATIBLE Dual Floppies, 128K RAM, Two RS-232 Serial ports, Centronic Printer port, IBM Compatible Keyboard, Hi-Res Color Graphics Card, Green or Amber Monitor and more with \$3,000 Software bundle
- COLUMBIA LOW TOTAL PRICE CALL

OTHER COMPUTERS

- EAGLE II Business Computer CALL
- EAGLE III Business Computer CALL
- EAGLE IV Business Computer CALL
- EAGLE 1630 Computer CALL
- All EAGLE CPUs Includes Software Bundles
- NEC PC-8001A, PC-8012A, PC-8031A, JB-1201, PC-8023 w/Software... \$1995
- (NEC SYSTEM)
- NEC PC-8800 8-BIT or 16-BIT w/Software CALL
- NEC APC SYSTEM 16 bit CALL
- SANYO MBC-1000 with Bundled Software \$1595
- SANYO MPC-3000 with Bundled Software CALL
- SANYO-NEW PC CALL

SOFTWARE

- STONEWARE CALL
- SUB LOGIC—FLIGHT SIMULATOR ... \$33
- VISI CORP—VISICALC \$239
- ASTON-TATE D BASE II \$465
- CONTINENTAL ACCOUNTING CALL
- I U S EASY WRITER \$89
- LOTUS CALL
- MICRO PRO WORD STAR \$372

MONITORS



COLOR RGB & OTHER MONITORS

- NEC JB-1205MA AMBER CALL
- NEC JC-1203DH(A) Hi-Res RGB \$599
- NEC JB-1201 Green CALL
- AMDEK Hi-Res RGC and others CALL
- PRINCKON GRAPHICS Hi-Res RGB CALL
- TAXAN Hi-Res RGB and others CALL

MODEMS

- HAYES SMARTMODEM (300 BAUD) .. \$227
- HAYES SMARTMODEM (300 & 1200) CALL
- HAYES CHRONOGRAPH \$199
- NOVATION J-CAT \$120
- NOVATION 212 AUTO-CAT CALL
- SIGNALMAN MARK I and others CALL
- U.D.S. Series Modems CALL

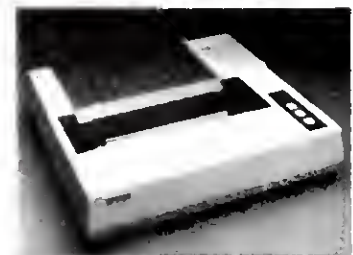
CARDS

- AMDEK RGB COLOR II INTERFACE . \$169
- M&R ENTERPRISES RGB INTERFACE \$69
- VIDWX VIDEOTERM CARD \$285
- B P O 16K EPSON, OKIDATA, NEC... \$159
- WIZARD IPL \$85
- OTHER APPLE CARDS CALL

PRINTERS

- EPSON FX Series CALL
- EPSON RX-80 w/GRAFRAX + CALL
- EPSON MX-100, 80, & F/T w/GRAFRAX + CALL
- OKIDATA 82A \$420
- OKIDATA 83A, 84A CALL
- OKIDATA 92, 93, 2350 & 2410 CALL
- NEC 3550 CALL
- NEC 3510, 3515, 3520, 3525, & 3530 CALL
- NEC 7710, 7715, 7720, 7725, & 7730 CALL
- NEC PC8023A-C \$449

NEC PRINTERS



OTHER PRINTERS

- BROTHERS HR-1 Serial or Parallel ... \$799
- CDMREX CR-1 Serial or Parallel CALL
- DAISYWRITER 2000 w/48K Buffer CALL
- TOSHIBA P1350-P or P1350-S \$1649
- SILVER-REED EXP550-P or EXP550-S CALL
- SMITH-CORONA TP-1 and others CALL
- GEMINI 10X \$355, GEMINI 15 \$499
- C.ITDH 8510 Parallel or Serial CALL
- C.ITDH 1550 Parallel or Serial CALL
- C.ITOH F10-40 and F10-55 Parallel or Serial CALL

CALL 7 DAYS (800) 854-8498 Calif. (714) 545-2216
COOSOL, INC., P.O. Box 2642, Costa Mesa, CA 92626-2642
 Computer Baron 3017 Harbor Blvd., Costa Mesa, CA 92626 (714) 979-2488

record scroll.

As it locates and displays each record containing the keys, the program waits for your instruction to continue, abort the search, print the record, or output the record to another disk file. Type L and press the enter key for line scroll to have Search pause after displaying each line. The default search display mode is record scroll.

You can print records found during a search continuously or manually. Type C and press the enter key to have each line printed as it appears on the screen. Type M and press the enter key to let you selectively print records or lines of text as they appear on the screen. The Search Display Mode determines whether a line or the entire record is printed. The default print mode is manual.

The output file name is the name of the file to which you want to transfer records. Enter the file name using standard TRSDOS notation to designate the name, extension, disk drive, and password. If you don't specify an output file name, the output file has the same specifications as the source file except for the extension OUT.

You can close, reset, or open the out-

put file. Type C and press the enter key to close an output file. Type R and press the enter key to reset the output file to the first sector. If the file is closed, this opens the file and sets it to the first sector.

Type A and press the enter key to append additional records to a file. The program retains previously written records. If the program finds the file closed, it opens it and sets the file pointer to the end-of-file marker. Using append on a newly created file is equivalent to resetting the file. The default output file status is closed.

You can write records found during a search to the output file continuously or manually. Type C and press the enter key to have each record written to the file as it's found. Type M and press the enter key to manually select records to be written to the output file. The default output file mode is manual.

While searching you might wish to display the text around a particular record. Tap L to call the list routine. A dotted line indicates that you changed from the search to the list mode. The message on the top line reads "Listing XXXXX", where XXXXX is the sector number. In the list mode, the program

sets the inset to zero while word wrap-around remains in effect.

Press the down-arrow key to display a line at a time. If you hold the down-arrow key (and the repeat key on the Model II), the file scrolls forward.

To backspace through the source file, press the up-arrow key and the text jumps back three sectors. The message "Backspace Three Sectors" appears. You can backspace to the beginning of the file in this manner.

While listing, you can continue your search where you left off by pressing the S key. A dotted line indicates that you've changed from listing to searching the source file. The message on the top line of the screen reads "Searching XXXXX".

You can write records found during searching or listing to a separate output file. Three of the options deal with the output file.

The default output file specification is the same as the index file but has the extension OUT. If you don't want to change the name, tap the enter key in response to the Output File Name prompt.

Typing R and pressing the enter key opens the output file and sets the output

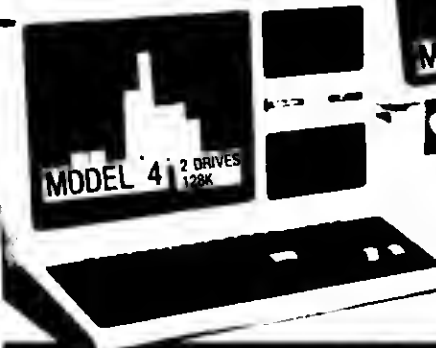
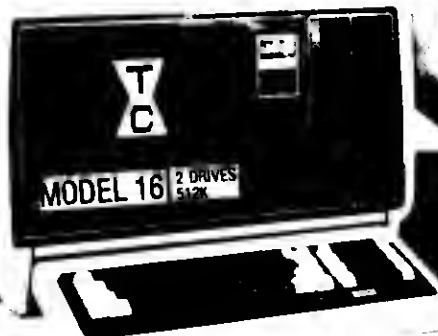
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file pointer to the first record. Typing A and pressing the enter key opens the output file and sets the file pointer to the end of the file so that you can append records to the file.

To close an open file, type C and press the enter key in response to the prompt. If the file is already closed, the program ignores the command. To bypass the output file status prompt, press the enter key and the status won't change.

You can write records to the output file as they appear by typing C and

pressing the enter key in response to the output mode prompt. Alternatively, you can select which records you want to copy to the output file by typing M and pressing the enter key in response to the output mode prompt.

As each record appears, you can copy it to the output file by pressing O before going on to the next record. Records are written to the output file in the same format they have in the source file.

With MAP, you can edit or index and search the output file. At the end of the search, either close the file (using the

options menu) or exit from the search program (the output file is closed whenever you exit Search).

You can print the entire contents of the screen by pressing W any time the program searches or lists lines of the source file on the screen. If the Search Display mode is set for record display, you can print the last record displayed any time while searching by pressing P.

If the Search Display mode is set for line display, you can print the display's bottom line at any time while searching by pressing the P key. If you do so and

Listing 6 continued

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00400 MPMFT PDB MC ;MC used as counter
00401 LD A,1
00402 LD (CURSOR),A ;non blinking cursor
00403 LD A,147
00404 LD (CURSOR),A ;large cursor over character
00405 LD MC,65535 ;cursor on
00406 CALL VDCRAB
00407 CALL KNCBAA
00408 CP 0
00409 JP NZ,MPMFT ;j/p if char entered
00410 DEC MC
00411 LD A,8
00412 OR C
00413 CP 0
00414 JP NZ,MPMFT ;j/p if char entered
00415 LD A,0
00416 LD (CURSOR),A ;blinking cursor
00417 LD A,176
00418 LD (CURSOR),A
00419 POP AP
00420 POP MC
00421 RET

00422 ;KBLIN and KBLINB
00423 KBLIN PDB
00424 LD A,83
00425 LD (KBLIN),A
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Tired of swapping Disks from Inventory to Accounts Receivable
to Accounts Payable etc.? Now, one system does it all.

Introducing

The M.B.S. Business Management System

At last a completely Integrated, Menu driven System for:

- **INVOICING**
 - Opens Customer Files
 - Opens A/R Accounts
 - Updates Inventory
 - Stores Mail List Files
 - Stores Sales Records
 - Computes Sales Tax
- **CUSTOMER FILES**
 - Maintains Order Status
 - Prints Labels
 - Prints Customer Balances
 - Stores Order Amounts
 - Stores Order Payments
 - Prints Statements
- **MAIL LABELS**
 - Stores by Variable File Names
 - Sorts by Zip Code
 - Sorts by Name
- **INVENTORY**
 - Sets Upper and Lower Limits
 - Generates Purchase Orders
 - Lists Inventory by Vendor
- **ACCOUNTS RECEIVABLE**
 - Open A/R Accounts
 - Generates Monthly Statements
 - Interest and Non-Interest Accounts
 - Listing of Accounts Balances
 - Manually Enter Charges and Payments
- **ACCOUNTS PAYABLE**
 - Enter Charges to Accounts
 - Enter Payments to Accounts
 - List Payable Balances
- **CHECK WRITING**
 - Print or Record Checks
 - Maintains Bank Balance
 - Credit Accounts Payable
 - Stores Expense Totals
- **FINANCIAL STATEMENTS**
 - Prints Sales Reports
 - Prints Operating Statements
 - Prints Receipts Reports
 - Modifies Expense and Sales Totals

Yes, now there is a complete business system for the small business man. With our Business Management System, you can increase sales with our mail label function. Complete your Schedule C in as little as 15 minutes. Know what your business is doing, and maintain other important business functions.

This easy to use system comes complete with instruction manual, and diskette on Oasplus mini TDOS operating system with extended Basic, and one year support. All programs are in Basic, and require two disk drives and 48K RAM. If you have waited for the right business software for your business, your wait is over. Our current users love our system and you will too.

Special Introductory Price \$249.⁹⁵

GAMEMASTER

Do you get complaints from your spouse, family and friends that you isolate yourself from them while "playing" with your computer? Do you wish there was a game that could get everyone involved? Do you enjoy creative expressions as well as playing games? If so, we have a unique Program/Game which could be the answer. It's called GAMEMASTER.

This program lets you easily develop and play your own adventure games. It does not create a game which you play against the computer, but creates a game which you the game creator, direct the game play while your computer maintains the game conditions and resolves combat.

GAMEMASTER package includes routines for creating player characters, creatures, items (weapons, armour, implements, or treasures), and environment (time, location etc.). Comes on diskette with sample scenario. Requires one disk drive and 48k ram.

Price \$39.⁹⁵

Specify Model I, Model III, Model IV, or LNW
Dealer Inquiries Invited

PRINTERS		PERIPHERALS		L.N.W.		SOFTWARE	
Prowriter	\$ 379	Hayes Smartmodem	\$ 219	LNW80 II	\$ 1495	DOSPLUS 3.5	\$ 119
Prowriter 2	\$ 699	Hayes 300/1200	\$ 539	LNDoublet w/DOS	\$ 199	DOSPLUS IV	\$ 119
Starwriter F10	\$ 1299	Holmes VID 80	\$ 259	System Expansion	\$ 399	MTERM	\$ 69
Okidata 82A	\$ 409	Holmes CPM 2.2	\$ 109	MONITORS		TRSDOS 6.0 Plus Enhance	\$ 45
Okidata 83A	\$ 649	64K Ram	\$ 114	Amdek 300G	\$ 149	Super Utility Plus	\$ 69
Okidata 92	\$ 509	Holmes DX3DC	\$ 157	Amdek 300A	\$ 159	Newsprint 7.1	\$ 99
Okidata 93	\$ 899	Holmes DX4DC	\$ 157	Amdek Color I	\$ 339	Newsprint w/labels	\$ 109
Silver Reed	\$ 499	Holmes High Speed Ram	\$ 29	Amdek Color II	\$ 469	File Converter	\$ 20
Mannesmann Tally	Call	Holmes Sprinter I	\$ 89	Taxan Amber	\$ 149	Trashmen	\$ 35
NEC	Call	Holmes Sprinter III	\$ 89	Taxan Green	\$ 139	Faster	\$ 27
Transfer	Call	Holmes Sprinter KX	\$ 129	Taxan RGB I	\$ 319	Tallymaster	\$ 69
		Diskettes	Call	Taxan RGB III	\$ 599	Electric Webster	\$ 129



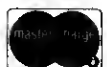
Microcomputer Business Systems

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the printer isn't ready, the program pauses until you press the break key.

You can exit from the Search program by pressing the break key while it lists or searches text, or by pressing the break key in response to the "Enter Key" message. The minimenu appears again on the top line. Press T to return to TRSDOS.

Possible Applications

Entering reference collections in disk files and searching with Search eliminates extensive cross-indexed card files

or specially coded computer files. You can enter titles, authors, or journal names in any order. You can also add key words to the record.

Search's output option is helpful when composing the reference section of any research or technical paper. Search your reference files for the appropriate references and copy them to an output file. You can incorporate the output file into a manuscript or edit it as an independent file.

You can keep information about clients or club members in text format

and retrieve it rapidly with Search. A realtor could keep a record of each client, type of property required, geographic location, and price range. When a new property becomes available, he could search for the appropriate keys and locate the clients who might be interested. He could also use the program to select properties a new client might want to purchase.

You can search parts listings rapidly. Each record of a file could store information on automobile parts, and contain a description of part, stock num-

Listing 6 continued

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00035 CTRL MOV          ;control char entered
00036 CP              ? CR
00037 JP              2,CTRLRD
00038 CP              0
00039 JP              2,CTRLRD
00040 CP              1
00041 JP              1,CTRLRD
00042 JP              0,CTRLRD
00043 CTRLRD MOV          ;other CTRL not allowed
00044 LD              A,C
00045 CP              0
00046 JP              1,CTRLRD
00047 LD              A,0
00048 CALL            VOCHAR
00049 LD              A,BKKEY
00050 LD              X,B
00051 MOV              A,BKKEY
00052 CTRLRD MOV          ;other CTRL not allowed
00053 LD              A,C
00054 CP              0
00055 JP              1,CTRLRD
00056 LD              A,0
00057 CALL            VOCHAR
00058 LD              A,BKKEY
00059 LD              X,B
00060 MOV              A,BKKEY
00061 CTRLRD MOV          ;other CTRL not allowed
00062 LD              A,C
00063 CP              0
00064 JP              1,CTRLRD
00065 LD              A,0
00066 CALL            VOCHAR
00067 LD              A,BKKEY
00068 LD              X,B
00069 MOV              A,BKKEY
00070 CTRLRD MOV          ;other CTRL not allowed
00071 LD              A,C
00072 CP              0
00073 JP              1,CTRLRD
00074 LD              A,0
00075 CALL            VOCHAR
00076 LD              A,BKKEY
00077 LD              X,B
00078 MOV              A,BKKEY
00079 CTRLRD MOV          ;other CTRL not allowed
00080 LD              A,C
00081 CP              0
00082 JP              1,CTRLRD
00083 LD              A,0
00084 CALL            VOCHAR
00085 LD              A,BKKEY
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00089 LD              A,C
00090 CP              0
00091 JP              1,CTRLRD
00092 LD              A,0
00093 CALL            VOCHAR
00094 LD              A,BKKEY
00095 LD              X,B
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00098 LD              A,C
00099 CP              0
00100 JP              1,CTRLRD
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00102 CALL            VOCHAR
00103 LD              A,BKKEY
00104 LD              X,B
00105 MOV              A,BKKEY
00106 CTRLRD MOV          ;other CTRL not allowed
00107 LD              A,C
00108 CP              0
00109 JP              1,CTRLRD
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00111 CALL            VOCHAR
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00118 JP              1,CTRLRD
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00135 CP              0
00136 JP              1,CTRLRD
00137 LD              A,0
00138 CALL            VOCHAR
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00141 MOV              A,BKKEY
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00143 LD              A,C
00144 CP              0
00145 JP              1,CTRLRD
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00147 CALL            VOCHAR
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00150 MOV              A,BKKEY
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00153 CP              0
00154 JP              1,CTRLRD
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00210 CALL            VOCHAR
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00252 CP              0
00253 JP              1,CTRLRD
00254 LD              A,0
00255 CALL            VOCHAR
00256 LD              A,BKKEY
00257 LD              X,B
00258 MOV              A,BKKEY
00259 CTRLRD MOV          ;other CTRL not allowed
00260 LD              A,C
00261 CP              0
00262 JP              1,CTRLRD
00263 LD              A,0
00264 CALL            VOCHAR
00265 LD              A,BKKEY
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00272 LD              A,0
00273 CALL            VOCHAR
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00277 CTRLRD MOV          ;other CTRL not allowed
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00281 LD              A,0
00282 CALL            VOCHAR
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00285 MOV              A,BKKEY
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00291 CALL            VOCHAR
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00298 JP              1,CTRLRD
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00300 CALL            VOCHAR
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00999 CP              0
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Listing 6 continued

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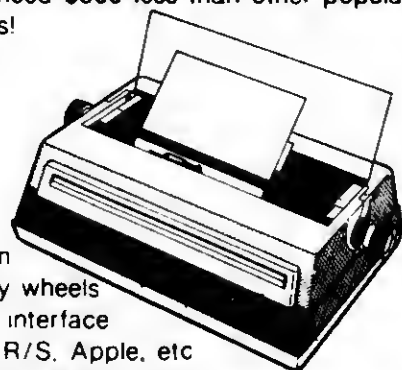
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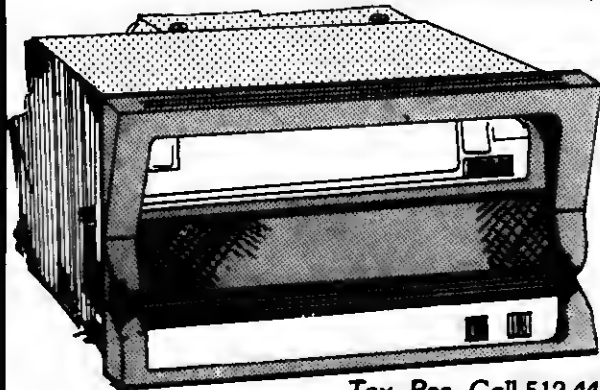
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MICRO DESIGN

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ber, manufacturer, model number, and equivalent products from other manufacturers. A customer needs a water pump for a 1970, 250-cubic-inch Chevrolet. Type in Chevro + 1970 + 250ci and the appropriate records appear with the model number, your stock number, and price.

Limitations

The Mindex and Search programs have several limitations. First, you must reindex the source file whenever you modify it, and you can't modify the source file directly from the search program.

The major limitation on modifying a record-compressed text file is that if the modified record is longer than the original, you can't modify it in place. You can overcome this problem by deleting the old record (overwriting it with O's or some other character) and appending the modification to the end of the file.

One disadvantage of this method is that with extensive use the file size quickly becomes too large and you must use a reformatting utility to reorganize the file (eliminating the deleted records). A minor disadvantage is that the position of a record within a file changes every time you modify it.

My solution to this problem (a program called 3by5) is to assign one record per sector. Although this method doesn't optimize disk space, it's simple to implement and doesn't require pe-

riodic file maintenance with a reformatting utility.

Another problem with Mindex and Search is that they are designed for systems with disk drives. Random access is slow on disk drives, and Search bypasses this problem by storing as much of the index file in RAM as possible. Large hard disk files can have indexes one or two orders of magnitude greater than available memory.

The solution is simple: 251 random access records are set aside for the index file. The n^{th} bits of all the signature strings are stored in the n^{th} logical record of the file. Only the index records corresponding to the hash values of the search key are read from the disk. You don't need to sequentially read the entire index file.

This file access method, however, requires multiple, nonsequential disk reads from the index file, and a floppy disk based system is too slow. I am in the process of modifying Mindex and Search for TRSDOS, TRS-XENIX, and LDOS hard-disk systems.

Future of Text Storage

Several publishing companies have plans to distribute textual material on laser video discs. These discs hold large amounts of information (text, numerical, program, and pictorial), can be interfaced to microcomputers, and can be mass produced.

The tremendous amount of information stored on the video disc creates a

problem. How can you rapidly search large text files (reference works such as encyclopedias, thesauruses, and so on)? Sequential access methods are too slow for these huge files. Tree-searching algorithms aren't appropriate for text.

Signature screening is a partial answer to this problem. You must make substantial modifications to apply this method to extremely large files stored on machines with relatively slow direct access times. The goal is to devise hashing algorithms that maximize the specificity of the screening test (reduce collisions).

The application of signature screening isn't limited to text files. With modification, you can apply it to records with fixed fields. Indexed sequential and signature screening methods can access a data file. You can extend the concept of signature screening in Mindex and Search to include many sophisticated applications. ■

Joseph E. Trojak is the president of Softshell Corporation, P.O. Box 18522, Baltimore, MD 21237. Softshell sells 3by5, an enhanced information retrieval system that incorporates Mindex and Search.

Mindex and Search are available from the author at \$12.50 for a TRSDOS 1.3 Model III/4 disk and \$14 for a TRSDOS 2.A Model II/12/16 disk. Specify source code or the assembled version. The price includes U.S. postage; Maryland residents must add 5 percent sales tax.

Listing 6 continued

```

00062      JP      DOSCMD      ;just in case
00063      ;
00064      ;EARDSP
00065      ;error display
00066      ;set bit 6 (detailed error msg) and
00067      ;set bit 7 (return to caller)
00068      CALL     DERDSP
00069      RET
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00071      ;
00072      DISABK  RET      ;for Mod II compatibility
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Program Listing 7. Assembly-language listing of S30PT/SRC.1.

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00001      ;S30PT/SRC.1.2
00002      ;Jun 22, 1983
00003      ;
00004      ;SEARCH OPTIONS ROUTINE
00005      ;COPYRIGHT 1983 SOFTSHELL CORPORATION ALL RIGHTS RESERVED
00006      ;
00007      ;S30PT S30PT      ;start of relocatable program section
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00389
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00207 LD HL,KEYBUF
00208 CALL VOLUME
;display output file name
00209 LD A,(OFSTAT)
00210 CP 'C'
00211 JP NZ,OPT#5E
00212 LD SL,OPFRNE
00213 LD DE,OUTDCB
00214 CALL APPEND ;move file spec to OUTDCB
00215 NOP
00216 J.....
;OPT#5
00217 J.....
;.....
00218 J.....
00219 J.....
00220 OPT#5 CALL OPTPCB
00221 LD HL,OPMGSA
00222 CALL VOLUME
00223 LD B,B
; (PMGUL)=cl
; (R)eat, (A)ppend or (C)lose'B
00224 CALL OPTPC
;rl=c(OPTCOL+1)
00225 LD HL,ANSWER
00226 LD B,1
00227 CALL RBLIN3
00228 LD A,B
00229 CF A
00230 JB K,OPT#5E ;jp OPT#5E if oull entry
00231 LD A,(ANSWER)
00232 PBE B,A ; convert to upper case
00233 LD (ANSWER),A
00234 CP 'C'
00235 JP I,OPT#5C
00236 CP 'R'
00237 JP Z,OPT#5R
00238 CP 'A'
00239 JP Z,OPT#5A
00240 OPT#5C OPT#5
;loop until valid entry
00241 LD A,(OFSTAT)
00242 CP 'C'
00243 JP Z,OPT#5D
;file already closed
00244 LD DE,OUTDCB ;DE=output file DBC
00245 CALL CLOSE ;close output file
00246 JP OPT#5D
J.....
;OPT#5A
00247 J.....
00248 J.....
00249 J.....
00250 OPT#5R CALL OPNOUT
;open output file and reset
;file cursor to start of file
00251 LD A,(OFSTAT)
00252 CP 'C'
;open output file
00253 CP 'I,OPT#5
;loop if error in opening file
00254 LD DE,OUTDCB ;DE=output file DCB
00255 JC B,1
;position file cursor to first record
00256 CALL POSB
00257 JP OPT#5D
J.....
;OPT#5A
00258 J.....
00259 J.....
00260 J.....
00261 OPT#5A CALL OPNOUT
;open output file and set file
;file cursor to EOF
00262 LD A,(OFSTAT)
00263 CP 'C'
;open output file
00264 CP 'I,OPT#5
;loop if error in opening file
00265 LD DE,OUTDCB
00266 CALL POSBOF
;position to end of file
00267 J.....
;OPT#5D
00268 J.....
00269 J.....
00270 OPT#5D LD A,(ANSWER)
00271 LD (OPCOND),A
00272 LD B,B
00273 OPT#5H LD A,(OPPC
;rl=c(OPTCOL+1)
00274 LD A,(OPCOND)

```

```

0068      EXTERN  PENULN      ;next to last line on screen (23 or 15)
0069      EXTERN  SWIDTH      ;screen width (80 or 84)
0070
0071      ;-----
0072      ;call to GR (general routines)
0073      ;-----
0074      EXTRN  BXDEC        ;binary to decimal conversion
0075      EXTRN  DC2BC        ;decimal to binary conversion
0076      EXTRN  DLIME        ;display dotted line (e.g., .....I
0077      EXTRN  DSPWNR        ;display 5-digit decimal no. (right justified)
0078      EXTRN  DSPWBL        ;display 5-digit decimal no. (left justified)
0079      EXTRN  EATNME        ;remove leading blanks
0080      EXTRN  FSPFC        ;merge and line file spec to RETRUP
0081      EXTRN  GETMFM        ;get MAP file names
0082      EXTRN  LINE         ;display line (from char in A reg)
0083      EXTRN  PACKFS        ;pack (compress) file spec in filed table
0084      EXTRN  PANSFE        ;parse one file spec
0085      EXTRN  RECS         ;zero-out 256-byte record
0086      EXTRN  RECBL        ;blank-out 256-byte record
0087      EXTRN  TAREXT        ;"Tap enter to continue"
0088
0089      ;-----
0090      ;GR buffers
0091      ;-----
0092      EXTRN  SHAW,SEXT,SPSW,SDOR ;source file table
0093      EXTRN  INAM,EXT,IPSW,IDOR  ;index file table
0094
0095      ;-----
0096      ;-----
0097      ;-----
0098      ;-----
0099      ;-----
0100      ;INDEX MAIN SEGMENT
0101      ;INDEX for loading programs
0102      ;options)
0103      ; R=record format or P=paragraph format
0104      ; T=return to TSDOS or A=return to MAP
0105      ; R and A are default values
0106
0107      ;-----
0108      BEGIN  PUSH  HL      ;HL=cmd line buffer
0109      ;save while break is disabled
0110      CALL  DISBRK        ;disable break on Model II
0111      POP  HL             ;HL=cmd line buffer
0112      CALL  FSPFC          ;get cmd line file spec if any
0113      ;clear screen
0114      LD  HL,TITLE        ;point to title
0115      CALL  VOLIME         ;display title
0116      LD  BC,COPYPOS      ;copyright notice coordinates (Mod II/III)
0117      CALL  POSCUR         ;file Model II, cfile Model III
0118      LD  BL,CPTMSG        ;point to copyright notice
0119      CALL  VOLIME         ;display copyright notice
0120      LD  A,"-"          ;select "-" char for LINE routine
0121      CALL  LINE          ;draw dashed line under title
0122
0123      ;-----
0124      ;FNN1
0125
0126      FNBI  LD  A,"R"      ;set default values
0127      LD  A,(FORMAT),A    ;default indexing format = record
0128      LD  A,"M"          ;
0129      LD  A,(EXDCD),A     ;default = return to MAP when done
0130      LD  BC,3+256        ;
0131      CALL  POSCUR        ;
0132      LD  A,(E23C),A     ;
0133      CALL  ERASES        ;erase to end of screen
0134      LD  HL,FNNMSG       ;point to file name msg ("File Name;")
0135      CALL  VOLIME        ;display file name message
0136      LD  A,PENULN        ;point to next to last line
0137      LD  C,8             ;
0138      CALL  POSCUR        ;e23C) Mod II, i35C) Mod III
0139      LD  BL,FNNMSG       ;point to following message:
0140
0141      ;-----
0142      ;enter name of file to be indexed or

```

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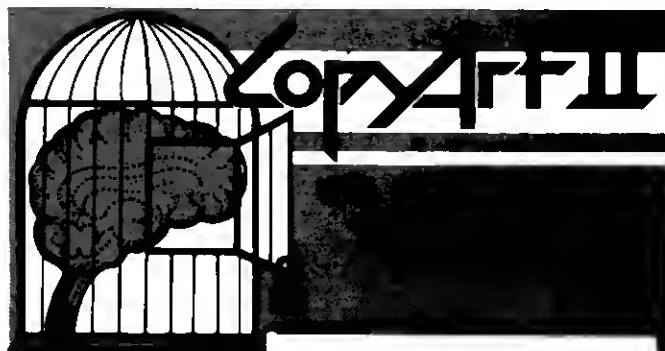
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Continued on page 211

Listing 8 continued

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00132      CALL VDLINR      /? to help'
00133      /display message
00134
00135      LD A,(CNDLFS)    /CNDLFS indicates whether file spec
00136      /was entered after HNDEN on TRDSDBS cm
00137      CP 'Y'           /was file spec entered on TRDSDBS and 1
00138      JR FN#02         /jp if file name not entered
00139
00140      /.....
00141      LD BC,1*256+11   /file spec entered on cmd line so dep
00142      CALL POSCUR      /r#c12
00143      LD A,'H'         /reset CNDLFS
00144      LD (CNDLFS),A
00145      LD HL,KEYBUF     /point to end line file spec
00146      CALL VDLINR      /display file spec
00147      LD A,BDH
00148      CP A
00149      LD B,1
00150      JR ZAB4          /if (set)
00151                      /if (a0 len > 8)
00152
00153      FN#2             /
00154      LD BC,1*256+11   /get file spec
00155      CALL POSCUR      /r#c12
00156      LD HL,KEYBUF     /point to end of line
00157      LD B,51          /point to KEYBUF to hold file spec
00158      CALL KBLINS      /was file spec = 51 characters
00159                      /enter file spec
00160
00161      FN#4             /
00162      PUSH AF          /now process file spec
00163      CALL ERASES      /
00164      LD BC,5*256
00165      CALL POSCUR      /
00166      CALL ERASES      /
00167      POP BL           /
00168      POP AF           /decrease to end of screen
00169
00170      /
00171      CP BKEYEY        /was break? entered?
00172      JF X,MSMENU1     /if so jp to mini-menu 1
00173      LD A,(KEYBUF)    /get first char entered
00174      CP BDH           /was first char BDH (i.e., null entry)?
00175      JF FN#1         /loop if null entry
00176      LD HL,KEYBUF     /point to file spec buffer
00177      CALL EXTNG      /bypass leading blanks
00178      LD A,(HL)        /load A with first non-blank char
00179      CP '?'           /was '?' entered?
00180      JF X,NEELF      /if so jp to help screen
00181
00182      /
00183      LD HL,KEYBUF     /point to file spec buffer
00184      GETPM3           /get file name
00185      JR Z,FNOK        /jp to FNOR if file spec syntax OK
00186      LD BC,8*256
00187      CALL POSCUR      /file spec syntax incorrect
00188      LD HL,FNMSG      /point to file name error msg
00189      CALL VDLINR      /display file name error msg
00190      LD HL,TAPET1     /Tap enter key to continue
00191      JP FN#2         /loop back and get file spec again
00192
00193      /
00194      FN#6             /
00195      POP             /file name ok
00196      CALL CIOPT       /call command interpreter options rout
00197      JP NE,OPTERR     /jp to options error routine if error
00198
00199      /
00200      LD HL,INAM       /HL->source file name
00201      LD DE,INDCB      /DE->source file DCB
00202      CALL PACKFS      /space compress source file spec
00203      LD HL,INAM       /and move to source file DCB
00204
00205      /
00206      LD HL,INAM       /HL-> index file table
00207      LD DE,MAPDCB     /DE-> index file DCB
00208      CALL PACKFS      /space compress index file spec
00209      LD HL,INAM       /and move to index file DCB
00210
00211      /
00212      LD BC,7*256
00213      CALL POSCUR      /r#c18
00214      LD HL,MSG99      /pt to msg 'source file name:'
00215      CALL VDLINR      /dep msg
00216      LD HL,INDCB      /HL->source file DCB
00217      CALL VDLINR      /display source file spec
00218
00219      /
00220      LD BC,8*256
00221      CALL POSCUR      /r#c1
00222      LD HL,MSG10      /'map index file name:'
00223      CALL VDLINR      /dep above msg
00224      LD HL,MAPDCB     /HL->index file DCB
00225      CALL VDLINR      /display index file spec
00226      LD HL,DIFFILE    /jp to section to open files
00227
00228      /
00229      LD HL,OPTERR      /HL->options error message
00230      CALL VDLINR      /dep options error msg
00231      LD HL,TAPET1     /Tap enter key to continue
00232      JP FN#1         /loop back and get file spec
00233
00234      /
00235      OPTERR           /
00236      CALL DIFFILE     /DIFFILE
00237
00238      /
00239      LD HL,MSG11      /'open files'
00240      CALL VDLINR      /dep above msg
00241      LD BC,1*256
00242      CALL POSCUR      /r#c12
00243      LD HL,INDCB      /HL->source file DCB
00244      LD DE,MAPDCB     /DE->index file DCB
00245      CALL VDLINR      /check if file spec's different
00246      LD HL,DIFFILE    /
00247      CP (HL)          /not equal so dif names
00248      JF FN#1         /BDH => same file names
00249      LD HL,INDCB      /
00250      LD HL,MAPDCB     /
00251      LD HL,DIFFILE    /
00252      LD HL,MSG12      /BDH
00253      LD HL,MSG13      /
00254      LD HL,MSG14      /
00255      LD HL,MSG15      /
00256      LD HL,MSG16      /
00257      LD HL,MSG17      /
00258      LD HL,MSG18      /
00259      LD HL,MSG19      /
00260      LD HL,MSG20      /
00261      LD HL,MSG21      /
00262      LD HL,MSG22      /
00263      LD HL,MSG23      /
00264      LD HL,MSG24      /
00265      LD HL,MSG25      /
00266      LD HL,MSG26      /
00267      LD HL,MSG27      /
00268      LD HL,MSG28      /
00269      LD HL,MSG29      /
00270      LD HL,MSG30      /
00271      LD HL,MSG31      /
00272      LD HL,MSG32      /
00273      LD HL,MSG33      /
00274      LD HL,MSG34      /
00275      LD HL,MSG35      /
00276      LD HL,MSG36      /
00277      LD HL,MSG37      /
00278      LD HL,MSG38      /
00279      LD HL,MSG39      /
00280      LD HL,MSG40      /
00281      LD HL,MSG41      /
00282      LD HL,MSG42      /
00283      LD HL,MSG43      /
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00345      LD HL,MSG105     /
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00350      LD HL,MSG110     /
00351      LD HL,MSG111     /
00352      LD HL,MSG112     /
00353      LD HL,MSG113     /
00354      LD HL,MSG114     /
00355      LD HL,MSG115     /
00356      LD HL,MSG116     /
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00358      LD HL,MSG118     /
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00360      LD HL,MSG120     /
00361      LD HL,MSG121     /
00362      LD HL,MSG122     /
00363      LD HL,MSG123     /
00364      LD HL,MSG124     /
00365      LD HL,MSG125     /
00366      LD HL,MSG126     /
00367      LD HL,MSG127     /
00368      LD HL,MSG128     /
00369      LD HL,MSG129     /
00370      LD HL,MSG130     /
00371      LD HL,MSG131     /
00372      LD HL,MSG132     /
00373      LD HL,MSG133     /
00374      LD HL,MSG134     /
00375      LD HL,MSG135     /
00376      LD HL,MSG136     /
00377      LD HL,MSG137     /
00378      LD HL,MSG138     /
00379      LD HL,MSG139     /
00380      LD HL,MSG140     /
00381      LD HL,MSG141     /
00382      LD HL,MSG142     /
00383      LD HL,MSG143     /
00384      LD HL,MSG144     /
00385      LD HL,MSG145     /
00386      LD HL,MSG146     /
00387      LD HL,MSG147     /
00388      LD HL,MSG148     /
00389      LD HL,MSG149     /
00390      LD HL,MSG150     /
00391      LD HL,MSG151     /
00392      LD HL,MSG152     /
00393      LD HL,MSG153     /
00394      LD HL,MSG154     /
00395      LD HL,MSG155     /
00
```

```

002802 PREHSH LD A,B ;set record len = 256
002803 LD HL,(DCBRLL),A ;r0=c38
002804 BC,7*256+37
002805 CALL POSCUR
002806 HL,OOKHSG ;'Opened' msg
002807 CALL VDLNLE
002808 )
002809 ;PREMAP
002810 )
002811 ;prepare MAP index file
002812 PREMAP LD HL,MAPBUF ;HL->index file buffer
002813 LD DB,MAPDCB ;DB->index file DCB
002814 LD B,0 ;record length = 256
002815 CALL INIT ;initialise (create or open) file
002816 JP 1,CMSGOP ;if to CMSGOP if index file init OK
002817 PUSH AF ;save error code
002818 LD BC,12*256 ;r13=c1
002819 CALL POSCUR
002820 HL,MSKERR ;'Error in opening index file'
002821 CALL VDLNLE ;dap error msg
002822 LD BC,13*256 ;r14=c1
002823 CALL POSCUR
002824 AF POP ;restore error code
002825 CALL ERRDSP ;dap TMSDOS error msg
002826 LD BC,14*256 ;r15=c1
002827 CALL POSCUR
002828 ;TAP enter key to continue
002829 LD HL,MSKERR ;dap back and get file spec
002830 CALL POSCUR ;index file open OK
002831 CMSGOP LD BC,8*256+37 ;r0=c38
002832 LD HL,OOKHSG ;'Opened' msg
002833 CALL VDLNLE
002834 )
002835 ;add header to MAP index file
002836 ;header format:
002837 ; bytes 0-19: MIBEX1.2..
002838 ; bytes 40-43: file spec.
002839 )
002840 LD A,BDH ;set source file drive no. to BDH [null]
002841 LD [SDDR],A ;since header never specifies disk drive
002842 ; of source file
002843 LD HL,SNAM ;HL->source file spec table
002844 LD DE,BFF ;DB->header file name buffer
002845 CALL PACKFS ;pack header with source file spec
002846 ;space compress file spec in process
002847 )
002848 LD HL,MAPBUF ;HL->index file buffer
002849 CALL RECB ;zero out index file buffer
002850 HL,MSKERR ;header sector
002851 LD DE,MAPSEC
002852 LD BC,50
002853 ;move header to MAPBUF
002854 LD LR DE,MAPDCB
002855 LD HL,WRITEX ;write index header sector (sector 0)
002856 JP 1,ERROR ;if to error routine if error
002857 LD BL,MAPBUF ;HL->index buffer
002858 CALL RECB ;initialise index buffer to 0's
002859 )
002860 LD BC,256*18 ;r11=c1
002861 CALL POSCUR
002862 LD HL,IDXSEC ;'Indexing Sector'
002863 CALL VDLNLE ;dap msg
002864 )
002865 ;files open and ready to
002866 ;start indexing process
002867 )
002868 ;main loop: read until file indexed
002869 LOOP CALL READIN ;get next sector from source file
002870 LD A,(ROERR) ;ROERR = error code during read
002871 CP 28 ;end of file?
002872 JP 1,ENDIN ;if to ENDIN if end of source file
002873 ;this is the only EXIT from this loop
002874 LD C,255 ;10 buffer length
002875 LD A,(SCROSS) ;no. of bytes in current record
002876 ;carried over from previous sector
002877 IF SCROSS=0 then record did not span sectors
002878 ;SCROSS never > 255
002879 LD B,A ;B now has number of bytes in record
002880 ;from previous sector
002881 ;shift all the words in current sector
002882 ;to return from HASHNO 32-byte after
002883 ;source file record buffer
002884 LD IX,now - last byte in src file rec buf
002885 ;get last char in SVRB
002886 ;r14 =
002887 ;if file indexed in paragraph format,
002888 ;the above BDB is converted to '. '
002889 ;if record does not span sector
002890 ;EOR ?
002891 ;if record does not span sector
002892 LD A,B
002893 LD (SCROSS),A ;store in SCROSS no. of bytes in record
002894 ;before sector boundary crossed
002895 ;loop until end of source file
002896 ;SCROSS=0 means record does not
002897 ;span sector boundary
002898 ;WHN at end of source file rec buf
002899 ;increment RCT
002900 ;loop until end of source file
002901 )
002902 ;HASHNO
002903 )
002904 ;hash word subroutine
002905 ;hashes all valid triplets in record
002906 ;hash algorithm for three chars c1,c2,c3
002907 ; ( ( (Bacc1+18acc2+acc3) and 255
002908 ; where c1,c2,c3 represent the 1st,2nd and
002909 ; 3rd char of the triplet
002910 ; a is the ASCII value of the char
002911 ; and upper case is converted to
002912 ; three 2-byte buffers are used:
002913 ;*BYT2=18acc1
002914 ;*BYT2=18acc2
002915 ;*BYT2=acc3
002916 )
002917 ;during hash loop reg B is used to store
002918 ;no. of bytes in current logical record
002919 ;value in B is transferred to SCROSS
002920 ;only when a record spans a sector
002921 ;and a new sector must be read from the
002922 ;source file
002923 ;during hash loop reg C is used to store
002924 ;no. of bytes remaining if strB
002925 )
002926 ;RASHNO LD HL,INBUF ;IX->source file record buffer (strB)
002927 RASHNO LD HL,(BYT2) ;move BYT2 to HL
002928 RASHNO LD HL,INBUF ;move BYT2 to HL
002929 LD HL,INBUF ;move BL to BYT2
002930 LD HL,INBUF ;move BL to BYT2
002931 LD HL,INBUF ;move BL to BYT2
002932 LD HL,INBUF ;move BL to BYT2
002933 LD HL,INBUF ;move BL to BYT2
002934 LD HL,INBUF ;move BL to BYT2
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002946 LD HL,INBUF ;move BL to BYT2
002947 LD HL,INBUF ;move BL to BYT2
002948 LD HL,INBUF ;move BL to BYT2
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002958 LD HL,INBUF ;move BL to BYT2
002959 LD HL,INBUF ;move BL to BYT2
002960 LD HL,INBUF ;move BL to BYT2
002961 LD HL,INBUF ;move BL to BYT2
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002964 LD HL,INBUF ;move BL to BYT2
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002974 LD HL,INBUF ;move BL to BYT2
002975 LD HL,INBUF ;move BL to BYT2
002976 LD HL,INBUF ;move BL to BYT2
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002980 LD HL,INBUF ;move BL to BYT2
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002990 LD HL,INBUF ;move BL to BYT2
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002993 LD HL,INBUF ;move BL to BYT2
002994 LD HL,INBUF ;move BL to BYT2
002995 LD HL,INBUF ;move BL to BYT2
002996 LD HL,INBUF ;move BL to BYT2
002997 LD HL,INBUF ;move BL to BYT2
002998 LD HL,INBUF ;move BL to BYT2
002999 LD HL,INBUF ;move BL to BYT2
003000 LD HL,INBUF ;move BL to BYT2
003001 LD HL,INBUF ;move BL to BYT2
003002 LD HL,INBUF ;move BL to BYT2
003003 LD HL,INBUF ;move BL to BYT2
003004 LD HL,INBUF ;move BL to BYT2
003005 LD HL,INBUF ;move BL to BYT2
003006 LD HL,INBUF ;move BL to BYT2
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003011 LD HL,INBUF ;move BL to BYT2
003012 LD HL,INBUF ;move BL to BYT2
003013 LD HL,INBUF ;move BL to BYT2
003014 LD HL,INBUF ;move BL to BYT2
003015 LD HL,INBUF ;move BL to BYT2
003016 LD HL,INBUF ;move BL to BYT2
003017 LD HL,INBUF ;move BL to BYT2
003018 LD HL,INBUF ;move BL to BYT2
003019 LD HL,INBUF ;move BL to BYT2
003020 LD HL,INBUF ;move BL to BYT2
003021 LD HL,INBUF ;move BL to BYT2
003022 LD HL,INBUF ;move BL to BYT2
003023 LD HL,INBUF ;move BL to BYT2
003024 LD HL,INBUF ;move BL to BYT2
003025 LD HL,INBUF ;move BL to BYT2
003026 LD HL,INBUF ;move BL to BYT2
003027 LD HL,INBUF ;move BL to BYT2
003028 LD HL,INBUF ;move BL to BYT2
003029 LD HL,INBUF ;move BL to BYT2
003030 LD HL,INBUF ;move BL to BYT2
003031 LD HL,INBUF ;move BL to BYT2
003032 LD HL,INBUF ;move BL to BYT2
003033 LD HL
```

Listing 8 continued

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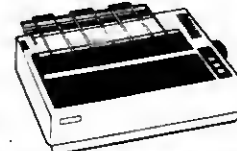
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Listing 8 continued

```

00433      ;do not convert to l.c.
00434      ;convert u.c. to l.c.
00435      ;c3 not a valid triplet char
00436      ;load HL with value of character
00437      ;start sector cross routine
00438      ;check SCROSS
00439      ;if SCROSS=0
00440      ;get c3 from strb again
00441      ;if file indexed in paragraph format,
00442      ;convert above 00H to ' '
00443      ;EOR 7
00444      ;EOR while SCROSS = 1
00445      ;shift sector ct
00446      ;reset SCROSS = 0
00447      ;get c3 from strb again
00448      ;if file indexed in paragraph format,
00449      ;convert above 00H to ' '
00450      ;EOR 7
00451      ;EOR while SCROSS = 0
00452      ;check rec len
00453      ;if SCROSS=0 no need to
00454      ;call NEWSEC routine
00455      ;check for rec >255 bytes
00456      ;rec >255 bytes
00457      ;reset can len = 0
00458      ;reset SCROSS = 0
00459      ;increment record len
00460      ;IX now -> next byte
00461      ;end 11/17/82 insert C
00462      ;check triplet for 0 val
00463      ;on return A=0 if any
00464      ;char in triplet has 0 value
00465      ;if 0 do not hash triplet
00466      ;HL=10000
00467      ;DE=10000
00468      ;HL,DE
00469      ;DE,DE
00470      ;(DE,DE)
00471      ;(DE,DE)+10000
00472      ;divisor
00473      ;A has end of 255 result
00474      ;set bit in approx. sig. sector byte
00475      ;check if end of record reached
00476      ;return if end of record
00477      ;continue to hash record until
00478      ;end of record (i.e. C=0)
00479      ;BUFLP end
00480      ;result 0 in A by 10
00481      ;BC end DE used
00482      ;value returned in HL
00483      ;multiply 0 in HL by 10
00484      ;HL contains 2*no.
00485      ;HL contains 4*no.
00486      ;HL contains 8*no.
00487      ;HL contains 10*no.
00488      ;STORE
00489      ;store bit in spare byte
00490      ;and output buffer
00491      ;set IX to point to index file buffer
00492      ;move hash value to IX
00493      ;add hash value (DE) to index file buffer
00494      ;sector pointer
00495      ;NEWSEC
00496      ;new source file sector so
00497      ;rotate A1CT bit
00498      ;write rec if new sector
00499      ;CHECKS
00500      ;check triplet for 0's
00501      ;if any char in triplet has 0 value,
00502      ;then triplet is not hashed
00503      ;blanks, EOR, control char give 0 value
00504      ;on return A=0 -> 0 value
00505      ;carry = 0
00506      ;carry = 0
00507      ;carry = 0
00508      ;zero value for triplet, do not hash
00509      ;read input record
00510      ;DE-source file BCB
00511      ;read next sector
00512      ;if read OK
00513      ;end of file?
00514      ;if to error routine if not EOR
00515      ;store EOP code in RERR
00516      ;DAPRRE

```

Listing 8 continued

```

00501      ;-----
00502      ;display current source file sector no.
00503      DEFSR  PUSB  BC
00504      PUSB  DB
00505      PUSB  9L
00506      PUSB  1A
00507      PUSB  1Y
00508      LD  BC,10*256+10 ;r11:c10
00509      CALL  POSCUR
00510      AL,(10DCBCR)
00511      CALL  REDEC
00512      ;load current source sector no. into BL
00513      ;convert binary to ASCII
00514      ;on return BL=buf with 5 digit ASCII value
00515      ;display ASCII value
00516      CALL  VDLINR
00517      POP  1Y
00518      POP  1A
00519      POP  BL
00520      POP  DE
00521      POP  SC
00522      RET
00523
00524      ;-----
00525      ;PERIOD
00526      ;sets '.' for paragraph format
00527      ;#00 is replaced with '.' to indicate
00528      ;end of record
00529      PERIOD LD  BL,POINT1
00530      INC  BL
00531      LD  (BL), '.'
00532      LD  BL,POINT2
00533      INC  BL
00534      LD  (BL), '.'
00535      LD  BL,POINT3
00536      INC  BL
00537      LD  (BL), '.'
00538      LD  BL,POINT4
00539      INC  BL
00540      LD  (BL), '.'
00541      LD  BL,RESECTP
00542      LD  (BL),ZEN
00543      RET
00544
00545      ;-----
00546      ;WRITER
00547      ;write output rec
00548      ;DB=Index file DCB
00549      ;leave BC
00550      ;write next sector
00551      ;if error
00552      ;pt to index file buffer
00553      ;set index file buffer to 0's
00554      ;restore BC
00555      WRITES LD  DE,MAPDCB
00556      PUSB  BC
00557      CALL  WRITR
00558      JP  ERROR
00559      LD  BL,MAPDCB
00560      CALL  RESE
00561      POP  BC
00562      RET
00563
00564      ;-----
00565      ;CLOPT
00566      ;command interpreter options routine
00567      ;BL -> first NB char after file spec
00568      ;bypass blanks before semicolon
00569      ;semicolon entered to mark options?
00570      ;if no options
00571      ;point to next char
00572      ;bypass any blanks after semicolon
00573      ;remove any leading blanks
00574      ;? EOR
00575      CLOPT CALL  SATNRK
00576      LD  A,(BL)
00577      CP  ' '
00578      JC  CPT2
00579      INC  BL
00580      CALL  SATNRK
00581      LD  A,(BL)
00582      CP  ' '
00583      JC  CPT2
00584      LD  A,(BL)
00585      CP  ' '
00586      JC  CPT2
00587      LD  A,(BL)
00588      CP  ' '
00589      JC  CPT2
00590      LD  A,(BL)
00591      CP  ' '
00592      JC  CPT2
00593      LD  A,(BL)
00594      CP  ' '
00595      JC  CPT2
00596      LD  A,(BL)
00597      CP  ' '
00598      JC  CPT2
00599      LD  A,(BL)
00600      CP  ' '
00601      JC  CPT2
00602      LD  A,(BL)
00603      CP  ' '
00604      JC  CPT2
00605      LD  A,(BL)
00606      CP  ' '
00607      JC  CPT2
00608      LD  A,(BL)
00609      CP  ' '
00610      JC  CPT2
00611      LD  A,(BL)
00612      CP  ' '
00613      JC  CPT2
00614      LD  A,(BL)
00615      CP  ' '
00616      JC  CPT2
00617      LD  A,(BL)
00618      CP  ' '
00619      JC  CPT2
00620      LD  A,(BL)
00621      CP  ' '
00622      JC  CPT2
00623      LD  A,(BL)
00624      CP  ' '
00625      JC  CPT2
00626      LD  A,(BL)
00627      CP  ' '
00628      JC  CPT2
00629      LD  A,(BL)
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00631      JC  CPT2
00632      LD  A,(BL)
00633      CP  ' '
00634      JC  CPT2
00635      LD  A,(BL)
00636      CP  ' '
00637      JC  CPT2
00638      LD  A,(BL)
00639      CP  ' '
00640      JC  CPT2
00641      LD  A,(BL)
00642      CP  ' '
00643      JC  CPT2
00644      LD  A,(BL)
00645      CP  ' '
00646      JC  CPT2
00647      LD  A,(BL)
00648      CP  ' '
00649      JC  CPT2
00650      LD  A,(BL)
00651      CP  ' '
00652      JC  CPT2
00653      LD  A,(BL)
00654      CP  ' '
00655      JC  CPT2
00656      LD  A,(BL)
00657      CP  ' '
00658      JC  CPT2
00659      LD  A,(BL)
00660      CP  ' '
00661      JC  CPT2
00662      LD  A,(BL)
00663      CP  ' '
00664      JC  CPT2
00665      LD  A,(BL)
00666      CP  ' '
00667      JC  CPT2
00668      LD  A,(BL)
00669      CP  ' '
00670      JC  CPT2
00671      LD  A,(BL)
00672      CP  ' '
00673      JC  CPT2
00674      LD  A,(BL)
00675      CP  ' '
00676      JC  CPT2
00677      LD  A,(BL)
00678      CP  ' '
00679      JC  CPT2
00680      LD  A,(BL)
00681      CP  ' '
00682      JC  CPT2
00683      LD  A,(BL)
00684      CP  ' '
00685      JC  CPT2
00686      LD  A,(BL)
00687      CP  ' '
00688      JC  CPT2
00689      LD  A,(BL)
00690      CP  ' '
00691      JC  CPT2
00692      LD  A,(BL)
00693      CP  ' '
00694      JC  CPT2
00695      LD  A,(BL)
00696      CP  ' '
00697      JC  CPT2
00698      LD  A,(BL)
00699      CP  ' '
00700      JC  CPT2
00701      LD  A,(BL)
00702      CP  ' '
00703      JC  CPT2
00704      LD  A,(BL)
00705      CP  ' '
00706      JC  CPT2
00707      LD  A,(BL)
00708      CP  ' '
00709      JC  CPT2
00710      LD  A,(BL)
00711      CP  ' '
00712      JC  CPT2
00713      LD  A,(BL)
00714      CP  ' '
00715      JC  CPT2
00716      LD  A,(BL)
00717      CP  ' '
00718      JC  CPT2
00719      LD  A,(BL)
00720      CP  ' '
00721      JC  CPT2
00722      LD  A,(BL)
00723      CP  ' '
00724      JC  CPT2
00725      LD  A,(BL)
00726      CP  ' '
00727      JC  CPT2
00728      LD  A,(BL)
00729      CP  ' '
00730      JC  CPT2
00731      LD  A,(BL)
00732      CP  ' '
00733      JC  CPT2
00734      LD  A,(BL)
00735      CP  ' '
00736      JC  CPT2
00737      LD  A,(BL)
00738      CP  ' '
00739      JC  CPT2
00740      LD  A,(BL)
00741      CP  ' '
00742      JC  CPT2
00743      LD  A,(BL)
00744      CP  ' '
00745      JC  CPT2
00746      LD  A,(BL)
00747      CP  ' '
00748      JC  CPT2
00749      LD  A,(BL)
00750      CP  ' '
00751      JC  CPT2
00752      LD  A,(BL)
00753      CP  ' '
00754      JC  CPT2
00755      LD  A,(BL)
00756      CP  ' '
00757      JC  CPT2
00758      LD  A,(BL)
00759      CP  ' '
00760      JC  CPT2
00761      LD  A,(BL)
00762      CP  ' '
00763      JC  CPT2
00764      LD  A,(BL)
00765      CP  ' '
00766      JC  CPT2
00767      LD  A,(BL)
00768      CP  ' '
00769      JC  CPT2
00770      LD  A,(BL)
00771      CP  ' '
00772      JC  CPT2
00773      LD  A,(BL)
00774      CP  ' '
00775      JC  CPT2
00776      LD  A,(BL)
00777      CP  ' '
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00997      JC  CPT2
00998      LD  A,(BL)
00999      CP  ' '
01000      JC  CPT2

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Listing 8 continued

NOW ONLY

\$99.00

Continued from page 207



20. SIMPLE CURSOR commands. Simply use the arrow keys to move your cursor around the text. The screen will scroll both vertically and horizontally. Shift arrows take you to the beginning or end instantly.

27. Hi-Resolution graphics supported.

28. COMPLETE MARGINS CONTROL. You tell CopyArt II what margins you desire. You can even change margins within the same text. You may also have parts of your text with 2 columns, some with one etc. It's super easy to use.

29. BASIC PROGRAMS can be edited easily. CopyArt is really useful for inserting graphics within quoted strings to give your programs super animation without the hassle of calculating the CHR\$ of the graphical.

30. VISICALC files can be loaded into CopyArt II to be manipulated easily. Great when you want to accompany your Visicalc reports with written reports, GRAPHS and BOLD FACING etc. Visicalc reports up to 255 wide can be loaded.

31. SPECIAL SCRIPTS FILE LOADER. Allows you to load your old Script files without having to save them in ASCII. Copyart will also load Pencil files and other normal ASCII files.

32. Similar to Scriptit. If you have used Scriptit, you can use Copy Art in minutes.

33. CONTROL CODES. Lets you insert special printer control codes in your text. CODES between 0 and 255.

34. BLOCK MOVE. Simple and powerful block move. Lets you move paragraphs or lines of text around easily. No complicated marker settings required.

35. FIND/REPLACE/REPEAT. Lets you find a string of characters and replace them with any other string of characters up to 20,000 times! WILDCARD search also supported.

36. Professional Manual in easy to understand English.

Copyart II requires a TRS-80 Model I or III, (or PMC-80 or LNW), 48k and 2 disk drives with Newdos-80, Ldos, Multidos, Dosplus or TRSDOS. Double density disk drives recommended for the Model I.

CopyArt II THIS PROGRAM DOES IT ALL!

PLEASE SPECIFY which COMPUTER and PRINTER you have when ordering.

Copyart II with one printer driver\$99.00
Additional printer drivers\$19.95 each

Copyart II owners. Updates available. To registered owners for \$15.00



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order to:

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DEALER, DISTRIBUTOR, & PRINTER/MANUFACTURER (INQUIRIES INVITED)
TRS-80 and Scriptit are TM of Radio Shack a Tandy corp.
*Indicates printer must have capability to do function.

```

00732 LD DE,INDCB ;DB->source file DCB
00733 CALL CLOSE ;close source file
00734 JF W1.ERROR ;if 1st error
00735 LD DE,MAPDCB ;DB->index file DCB
00736 CALL CLOSE ;close index file
00737 JF W1.ERROR ;if 1st error
00738
00739 LD A,(ENDCMD) ;get end cmd
00740 CP 'T' ;return to TRSDOS?
00741 JP 1,JP2DOS ;if to TRSDOS if true
00742 ENDINS LD HL,MAPCMD ;return to MAP Master Menu
00743 JP DORCMD ;if to TRSDOS and execute cmd
00744 MAPCMD DEFB 'MAP'
00745 DEFB 0DH
00746
00747 ;-----
00748 ; buffers used by R3
00749
00750 ; general purpose variables
00751 ; some byte key in variable (Y/N etc)
00752 ; not used by MINDEX but must be
00753 ; present in public or there will
00754 ; be a link error
00755 ; cmd line file spec (Y/N)
00756 ; indicates whether file spec
00757 ; was entered along with MINDEX cmd
00758 ; send cmd (R=MAP, T=TRSDOS)
00759 ; indexing format (R=record, F=file)
00760 ; used by MINDEX for file spec buffer
00761 ; precautionary EOR
00762
00763 ; hash routine variables
00764 ; hash value of first byte of triplet
00765 ; hash value of middle byte of triplet
00766 ; hash value of last byte of triplet
00767 ; sector cross variable
00768 ; if 0 then sector boundary is not
00769 ; crossed by a record
00770 ; if 0 then the value in SCROSS
00771 ; is equal to the no of bytes in record
00772 ; prior to end of sector
00773 ; bit points to sector (0 to 7)
00774
00775 ; disk I/O buffers
00776 ; read error storage
00777 ; source file buffer
00778 ; precautionary EOR for INBUF
00779 ; index file buffer
00780 ; precautionary EOR for MAPBUF
00781
00782 ; HEADEN buffer
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Program Listing 9. Assembly-language listing of S3/SRC.

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Ln 1 Source Line
00001 ;S3/SRC VERSION 1.1
00002 ;Jun 15, 1983
00003 ;-----
00004 ;SEARCH INFORMATION RETRIEVAL PROGRAM
00005 ;MAIN ROUTINE
00006 ;COPYRIGHT 1983, SOFTSHELL CORPORATION ALL RIGHTS RESERVED
00007 ;-----
00008 SEARCH PSECT ;begin relocatable program section
00009
00010 ; public routines
00011 ; main menu
00012 PUBLIC MENU2B
00013 PUBLIC OPNUOT
00014 PUBLIC OUTREC
00015 PUBLIC READIN
00016
00017 ; public variables
00018
00019 PUBLIC ANSWER ;1 byte switch
00020 PUBLIC RACRSP ;backspace through file routine
00021 PUBLIC REGIF ;start of SEARCH program
00022 PUBLIC CFILR ;current file name
00023 PUBLIC CNOLFS ;cmd line file spec (Y/N)
00024 ; indicates whether file spec also entered
00025 ; along with SEARCH cmd
00026
00027 PUBLIC CODE ;end of file switch
00028 PUBLIC INBUF ;input (source) file record buffer
00029 PUBLIC INBUFB ;last byte in input record (256ch)
00030 PUBLIC INBUFD ;byte after INBUFB
00031 PUBLIC KEYBUF ;keybuf used to enter MINDEX file spec
00032 PUBLIC LTRCSC ;
00033 PUBLIC LIBRNR ;
00034 PUBLIC MAPBUF ;
00035 PUBLIC RAKMAP ;
00036 PUBLIC EXTMAP ;
00037 PUBLIC OFNAME ;output file name
00038 PUBLIC PARFOR ;paragraph format routine
00039 PUBLIC RECFOR ;record format routine
00040 PUBLIC MODE ;display or list mode
00041 PUBLIC RINRST ;no. of spaces for inset
00042 PUBLIC EXTREC ;absolute position of next record
00043 PUBLIC OFCOMD ;output file status (O, R or A)
00044 PUBLIC OFNAME ;output file name buffer
00045 PUBLIC OFSTAT ;output file status (Open or Closed)
00046 PUBLIC ONODE ;output mode (C or R)
00047 PUBLIC PHONODE ;print mode (C or R)
00048 PUBLIC PSORA ;pseudo EOR char (if pats format then = 0DH)
00049
00050 PUBLIC RECBUF ;record buffer (record found during search)
00051 PUBLIC RENDODE ;search-display mode
00052 PUBLIC RINRST ;storage for inset value
00053 PUBLIC SPWNO ;space or word
00054
00055 ; public messages
00056
00057 PUBLIC MSGOPF ;'End of file' msg
00058 PUBLIC MSGMSG ;'Searching' msg
00059
00060 ; calls to MODII or MODIII
00061
00062 EXTERN BOTTOM ;position cursor to last line of screen
00063 EXTERN CLOSE ;close file (DB->DCB)
00064 EXTERN CURPOS ;determine cursor pos (ecorisc)
00065 EXTERN DISKERR ;display break (for Model II)
00066 EXTERN DIVIDE ;divide A into M
00067 EXTERN DSCMD ;if to TRSDOS and execute command
00068 EXTERN EREBEL ;return to end of line
00069 EXTERN ERASES ;return to end of screen
00070 EXTERN ERDSEP ;MAP error display routine
00071 EXTERN ERROR ;TRSDOS error msg routine
00072 EXTERN HOME ;position cursor to top line of screen
00073 EXTERN INIT ;initialize file (create/open, pos to 1st rec)
00074
00075 ; if to TRSDOS
00076 EXTERN KDCBMT ;get char (or null) from keyboard
00077 EXTERN KDIRAT ;initialize keyboard (Mod II)
00078 EXTERN KDIRNG ;get line from keyboard and end with 03
00079 EXTERN KBLINE ;get line from keyboard and end with 0DH
00080 EXTERN KSWAIT ;wait for char from keyboard
00081 EXTERN KTRIN ;get search key(s) from keyboard
00082 EXTERN KVELLN ;move line from screen to buffer
00083
00084 EXTERN NEMLN ;$L->buf, D=mo. char, DC=cursor row
00085 ; cols screen and pos cur to next to last line
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Listing 9 continued

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00174      EXTERN OPT      ;options routine
00175
00176      ;calls to $OPEN open files
00177
00178      EXTERN GETFILE
00179
00180      ;get file spec, open files and
00181      ;then load index into memory
00182
00183      ;SEARCH main segment
00184      ;syntax:
00185      ;SEARCH src file, lod file, out file; options
00186      ;options:
00187      ;- returns to TENDOS or M-return to MAP
00188      ;- M in default
00189      ;- HL=cmd line buffer
00190      ;- save while top of memory is found and
00191      ;- break is disabled
00192      ;- seek memory and (as many sig sectors as
00193      ;- possible will be stored in memory first
00194      ;- send of program to top of memory)
00195      ;- disable break on Mod II
00196      ;- HL=cmd line buffer
00197      ;- get cmd line file spec if any
00198      ;- load file spec into KEYBUF
00199      ;- if file spec present LD CNDLFS with 'Y'
00200
00201      LD A,B
00202      CALL SCAPRO
00203      CALL VDCLE
00204      LD HL, TITLE
00205      CALL DLHLE
00206      LD BC, CYPUS
00207      CALL POSCUR
00208      LD HL, CYPUS
00209      CALL VDLHLE
00210      LD BC, 1256
00211      CALL POSCUR
00212      LD A, ' '
00213      CALL LINE
00214
00215      ;initialise variables:
00216      LD A, 'Y'
00217      LD (MIDPUN), A
00218      LD A, 'M'
00219      LD (SDMODE), A
00220      LD A, 'M'
00221      LD (PRMODE), A
00222      LD (ONGOD), A
00223
00224      ;GETFSP
00225      GETFSP CALL GETFILE
00226
00227      ;then load index into memory
00228
00229      ;MASTLP
00230      ;master loop
00231      ;after each search the program returns
00232      ;to this point
00233
00234      MASTLP LD A, B
00235      LD (SDP), A
00236      CALL HOME
00237      CALL ERASEL
00238      LD HL, MASTLP
00239      LD BC, 1256
00240      CALL POSCUR
00241      LD HL, CFILE
00242      CALL VDLHLE
00243      LD A, 3
00244      CALL SCWRD
00245      LD BC, 2256
00246      CALL POSCUR
00247      LD A, ' '
00248      CALL LINE
00249      CALL GETKEY
00250      CP BRKKEY
00251      JP NC, MASTLP
00252      MASTLP LD HL, MASTLP
00253      LD BC, 1256
00254      CALL POSCUR
00255      LD A, ' '
00256      CALL LINE
00257      CALL GETKEY
00258      CP BRKKEY
00259      JP NC, MASTLP
00260      MASTLP LD HL, MASTLP
00261      LD BC, 1256
00262      CALL POSCUR
00263      LD A, ' '
00264      CALL LINE
00265      CALL GETKEY
00266      CP BRKKEY
00267      JP NC, MASTLP
00268      MASTLP LD HL, MASTLP
00269      LD BC, 1256
00270      CALL POSCUR
00271      LD A, ' '
00272      CALL LINE
00273      CALL GETKEY
00274      CP BRKKEY
00275      JP NC, MASTLP
00276      MASTLP LD HL, MASTLP
00277      LD BC, 1256
00278      CALL POSCUR
00279      LD A, ' '
00280      CALL LINE
00281      CALL GETKEY
00282      CP BRKKEY
00283      JP NC, MASTLP
00284      MASTLP LD HL, MASTLP
00285      LD BC, 1256
00286      CALL POSCUR
00287      LD A, ' '
00288      CALL LINE
00289      CALL GETKEY
00290      CP BRKKEY
00291      JP NC, MASTLP
00292      MASTLP LD HL, MASTLP
00293      LD BC, 1256
00294      CALL POSCUR
00295      LD A, ' '
00296      CALL LINE
00297      CALL GETKEY
00298      CP BRKKEY
00299      JP NC, MASTLP
00300      MASTLP LD HL, MASTLP
00301      LD BC, 1256
00302      CALL POSCUR
00303      LD A, ' '
00304      CALL LINE
00305      CALL GETKEY
00306      CP BRKKEY
00307      JP NC, MASTLP
00308      MASTLP LD HL, MASTLP
00309      LD BC, 1256
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00312      CALL LINE
00313      CALL GETKEY
00314      CP BRKKEY
00315      JP NC, MASTLP
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00338      CP BRKKEY
00339      JP NC, MASTLP
00340      MASTLP LD HL, MASTLP
00341      LD BC, 1256
00342      CALL POSCUR
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00358      CALL POSCUR
00359      LD A, ' '
00360      CALL LINE
00361      CALL GETKEY
00362      CP BRKKEY
00363      JP NC, MASTLP
00364      MASTLP LD HL, MASTLP
00365      LD BC, 1256
00366      CALL POSCUR
00367      LD A, ' '
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00779      JP NC, MASTLP
00780      MASTLP LD HL, MASTLP
00781      LD BC, 1256
00782      CALL POSCUR
00783      LD A, ' '
00784      CALL LINE
00785      CALL GETKEY
00786      CP BRKKEY
00787      JP NC, MASTLP
00788      MASTLP LD HL, MASTLP
00789      LD BC, 1256
00790      CALL POSCUR
00791      LD A, ' '
00792      CALL LINE
00793      CALL GETKEY
00794      CP BRKKEY
00795      JP NC, MASTLP
00796      MASTLP LD HL, MASTLP
00797      LD BC, 1256
00798      CALL POSCUR
00799      LD A, ' '
00800      CALL LINE
00801      CALL GETKEY
00802      CP BRKKEY
00803      JP NC, MASTLP
00804      MASTLP LD HL, MASTLP
00805      LD BC, 1256
00806      CALL POSCUR
00807      LD A, ' '
00808      CALL LINE
00809      CALL GETKEY
00810      CP BRKKEY
00811      JP NC, MASTLP
00812      MASTLP LD HL, MASTLP
00813      LD BC, 1256
00814      CALL POSCUR
00815      LD A, ' '
00816      CALL LINE
00817      CALL GETKEY
00818      CP BRKKEY
00819      JP NC, MASTLP
00820      MASTLP LD HL, MASTLP
00821      LD BC, 1256
00822      CALL POSCUR
00823      LD A, ' '
00824      CALL LINE
00825      CALL GETKEY
00826      CP BRKKEY
00827      JP NC, MASTLP
00828      MASTLP LD HL, MASTLP
00829      LD BC, 1256
00830      CALL POSCUR
00831      LD A, ' '
00832      CALL LINE
00833      CALL GETKEY
00834      CP BRKKEY
00835      JP NC, MASTLP
00836      MASTLP LD HL, MASTLP
00837      LD BC, 1256
00838      CALL POSCUR
00839      LD A, ' '
00840      CALL LINE
00841      CALL GETKEY
00842      CP BRKKEY
00843      JP NC, MASTLP
00844      MASTLP LD HL, MASTLP
00845      LD BC, 1256
00846      CALL POSCUR
00847      LD A, ' '
00848      CALL LINE
00849      CALL GETKEY
00850      CP BRKKEY
00851      JP NC, MASTLP
00852      MASTLP LD HL, MASTLP
00853      LD BC, 1256
00854      CALL POSCUR
00855      LD A, ' '
00856      CALL LINE
00857      CALL GETKEY
00858      CP BRKKEY
00859      JP NC, MASTLP
00860      MASTLP LD HL, MASTLP
00861      LD BC, 1256
00862      CALL POSCUR
00863      LD A, ' '
00864      CALL LINE
00865      CALL GETKEY
00866      CP BRKKEY
00867      JP NC, MASTLP
00868      MASTLP LD HL, MASTLP
00869      LD BC, 1256
00870      CALL POSCUR
00871      LD A, ' '
00872      CALL LINE
00873      CALL GETKEY
00874      CP BRKKEY
00875      JP NC, MASTLP
00876      MASTLP LD HL, MASTLP
00877      LD BC, 1256
00878      CALL POSCUR
00879      LD A, ' '
00880      CALL LINE
00881      CALL GETKEY
00882      CP BRKKEY
00883      JP NC, MASTLP
00884      MASTLP LD HL, MASTLP
00885      LD BC, 1256
00886      CALL POSCUR
00887      LD A, ' '
00888      CALL LINE
00889      CALL GETKEY
00890      CP BRKKEY
00891      JP NC, MASTLP
00892      MASTLP LD HL, MASTLP
00893      LD BC, 1256
00894      CALL POSCUR
00895      LD A, ' '
00896      CALL LINE
00897      CALL GETKEY
00898      CP BRKKEY
00899      JP NC, MASTLP
00900      MASTLP LD HL, MASTLP
00901      LD BC, 1256
00902      CALL POSCUR
00903      LD A, ' '
00904      CALL LINE
00905      CALL GETKEY
00906      CP BRKKEY
00907      JP NC, MASTLP
00908      MASTLP LD HL, MASTLP
00909      LD BC, 1256
00910      CALL POSCUR
00911      LD A, ' '
00912      CALL LINE
00913      CALL GETKEY
00914      CP BRKKEY
00915      JP NC, MASTLP
00916      MASTLP LD HL, MASTLP
00917      LD BC, 1256
00918      CALL POSCUR
00919      LD A, ' '
00920      CALL LINE
00921      CALL GETKEY
00922      CP BRKKEY
00923      JP NC, MASTLP
00924      MASTLP LD HL, MASTLP
00925      LD BC, 1256
00926      CALL POSCUR
00927      LD A, ' '
00928      CALL LINE
00929      CALL GETKEY
00930      CP BRKKEY
00931      JP NC, MASTLP
00932      MASTLP LD HL, MASTLP
00933      LD BC, 1256
00934      CALL POSCUR
00935      LD A, ' '
00936      CALL LINE
00937      CALL GETKEY
00938      CP BRKKEY
00939      JP NC, MASTLP
00940      MASTLP LD HL, MASTLP
00941      LD BC, 1256
00942      CALL POSCUR
00943      LD A, ' '
00944      CALL LINE
00945      CALL GETKEY
00946      CP BRKKEY
00947      JP NC, MASTLP
00948      MASTLP LD HL, MASTLP
00949      LD BC, 1256
00950      CALL POSCUR
00951      LD A, ' '
00952      CALL LINE
00953      CALL GETKEY
00954      CP BRKKEY
00955      JP NC, MASTLP
00956      MASTLP LD HL, MASTLP
00957      LD BC, 1256
00958      CALL POSCUR
00959      LD A, ' '
00960      CALL LINE
00961      CALL GETKEY
00962      CP BRKKEY
00963      JP NC, MASTLP
00964      MASTLP LD HL, MASTLP
00965      LD BC, 1256
00966      CALL POSCUR
00967      LD A, ' '
00968      CALL LINE
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00970      CP BRKKEY
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00972      MASTLP LD HL, MASTLP
00973      LD BC, 1256
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00999      LD A, ' '
01000      CALL LINE
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01002      CP BRKKEY
01003      JP NC, MASTLP
01004      MASTLP LD HL, MASTLP
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01014      CALL POSCUR
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01019      JP NC, MASTLP
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01022      CALL POSCUR
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01028      MASTLP LD HL, MASTLP
01029      LD BC, 1256
01030      CALL POSCUR
01031      LD A, ' '
01032      CALL LINE
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01034      CP BRKKEY
01035      JP NC, MASTLP
01036      MASTLP LD HL, MASTLP
01037      LD BC, 1256
01038      CALL POSCUR
01039      LD A, ' '
01040      CALL LINE
01041      CALL GETKEY
01042      CP BRKKEY
01043      JP NC, MASTLP
01044      MASTLP LD HL, MASTLP
01045      LD BC, 1256
01046      CALL POSCUR
01047      LD A, ' '
01048      CALL LINE
01049      CALL GETKEY
01050      CP BRKKEY
01051      JP NC, MASTLP
01052      MASTLP LD HL, MASTLP
01053      LD BC, 1256
01054      CALL POSCUR
01055      LD A, ' '
01056      CALL LINE
01057      CALL GETKEY
01058      CP BRKKEY
01059      JP NC, MASTLP
01060      MASTLP LD HL, MASTLP
01061      LD BC, 1256
01062      CALL POSCUR
01063      LD A, ' '
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01065      CALL GETKEY
01066      CP BRKKEY
01067      JP NC, MASTLP
01068      MASTLP LD HL, MASTLP
01069      LD BC, 1256
01070      CALL POSCUR
01071      LD A, ' '
01072      CALL LINE
01073      CALL GETKEY
01074      CP BRKKEY
01075      JP NC, MASTLP
01076      MASTLP LD HL, MASTLP
01077      LD BC, 1256
01078      CALL POSCUR
01079      LD A, ' '
01080      CALL LINE
01081      CALL GETKEY
01082      CP BRKKEY
01083      JP NC, MASTLP
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01149      LD BC, 1256
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01173      LD BC, 1256
01174      CALL POSCUR
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01177      CALL GETKEY
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01183      LD A, ' '
01184      CALL LINE
01185      CALL GETKEY
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01187      JP NC, MASTLP
01188      MASTLP LD HL, MASTLP
01189      LD BC, 1256
01190      CALL POSCUR
01191      LD A, ' '
01192      CALL LINE
01193      CALL GETKEY
01194      CP BRKKEY
01195      JP NC, MASTLP
01196      MASTLP LD HL, MASTLP
01197      LD BC, 1256
01198      CALL POSCUR
01199      LD A, ' '
0120
```

VOICE SYNTHESIZER FOR APPLE AND COMMODORE



JE520CM

• Over 250 word vocabulary - affixes allow the formation of more than 500 words • Built-in amplifier, speaker, volume control, and audio jack • Recreates a clear, natural male voice • Plug-in user ready with documentation and sample software • Case size 7 1/4" x 3 1/4" x 1 3/8"

APPLICATIONS:

- Security Warning
- Teaching
- Instrumentation
- Telecommunication
- Handicap Aid
- Games

The JE520 VOICE SYNTHESIZER will bring right into your computer how you wish to deliver your application. Utilizing Advanced Subsynthesizer (JMS) and Speech Processor IC, this voice synthesizer chip, the JE520 synthesizes natural speech and digital memory, including the original inflections and emphasis. The result is an extremely clear, natural vocalization.

Part No.	Description	Price
JE520CM	For Commodore 64 & VIC-20	\$114.95
JE520AP	For Apple II, II+, and IIx	\$149.95

Micro-Logic Corp. MICRO-CHARTS

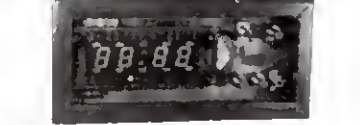
- Fully decoded data • Instant access • 2-level totally comprehensive • Compact 6 1/4" x 1 1/4" size • Card format • Perfect for programmers & engineers
- Clear & concise tables on bit instruction set, assembly, ASCII and control status of major components • Includes major structure, control, cycle times, diagrams, bus modes & much more

PART NO.	REFERENCE	PRICE
ML-Z80	Z80 CPU	\$5.95
ML-8080A	8080A/8085A	\$5.95
ML-6502	6502 (65XX)	\$5.95
ML-8048	8048, Relatives	\$5.95
ML-7400	5400/7400 TTL Pin-Outs	\$5.95

BOOKS

30001	National CMOS Data Book (1981)	\$6.95
30002	8401 pages: 74C, CD4000, and A/D Converters	
30003	National Linear Data Book (1982)	\$11.95
	(1378 pages) LM, LF, ADG, DAC, LH Series	
30008	National Memory Data Book (1980)	\$6.95
	(464 pages) RAMs, ROMs, PROMs, EPROMs Series	
30008	Interall Data Book (1983)	\$9.95
	(1356 pages) Complete line	
30010	National Audio/Video Handbook (1980)	\$6.95
	(240 pages) Pre Amps, AM, FM & FM Stereo, Power Amps	
30012	National PAL Data Book (1982)	\$5.95
	(178 pages) Application Notes, Linear, Bi-Dir, etc.	
30015	Zilog Data Book (1983)	\$7.95
	(841 pages) Microprocessors and Support Chips	
30030	Intel Memory Components Handbook (1983)	\$16.95
	(798 pages) Complete all Application Notes, Article Reprints, Data Sheets, and other design information on Intel's RAMs, EPROMs & SRAMs	
30084	Intel's RAMs, EPROMs & SRAMs Handbook (1983)	\$14.95
	(1587 pages) Complete Data Sheets on all of Intel's Microprocessors and Peripherals	

4-Digit Fluorescent Alarm Clock Kit

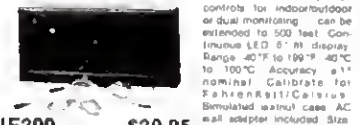


• Bright 4-digit 0.5" high display • 10 minute snooze alarm • AM/PM indicator

The JE750 Alarm Clock Kit is a versatile 12-hour digital clock with 24-hour alarm. The clock has a bright 4-digit high blue-green fluorescent display. The 24-hour alarm allows the user to choose the alarm and immediately re-programmable and can be set to 24 hours. The kit includes all components, documentation, and more. Case size 5 1/2" x 8 1/2" x 1 1/2".

JE750 Alarm Clock Kit \$29.95

Jameco Digital Thermometer Kit



JE300

Dual sensors - switch controls for indoor/outdoor or dual monitoring • Can be extended to 500 feet • Continuous LED 6" H display • Range 40°F to 199.9°F • 100°C accuracy • 1% nominal calibration for Fahrenheit/Celsius • Removable walnut case AC adapter included • Size 6 1/2" x 3 1/2" x 1 1/2"

JE300 \$39.95

Universal Computer Keyboard Enclosures

DTE-8	Panel Width 7 1/2"	\$24.95
DTE-11	Panel Width 10 1/2"	\$27.95
DTE-14	Panel Width 13 1/2"	\$29.95
DTE-20	Panel Width 18 1/2"	\$34.95
DTE-22	Panel Width 21 3/4"	\$39.95

CARD-EDGE CONNECTORS

Part No.	No. of Connectors	1.0	1.5	1.8
C20	20	2.30	2.90	3.40
C25	25	2.90	3.50	3.90
C30	30	3.50	4.10	4.50
C35	35	4.10	4.70	5.10
C40	40	4.70	5.30	5.70
C50	50	5.30	5.90	6.30

SOLETER TRANSITION CONNECTORS

FOR PERMANENT TERMINATION TO PRINTED CIRCUIT BOARDS

Part No.	No. of Connectors	1.0	1.5	1.8
S20	20	1.10	1.40	1.70
S25	25	1.40	1.70	2.00
S30	30	1.70	2.00	2.30
S35	35	2.00	2.30	2.60
S40	40	2.30	2.60	2.90
S50	50	2.90	3.20	3.50

SOCKET CONNECTORS

Part No.	No. of Connectors	1.0	1.5	1.8
S20	20	1.10	1.40	1.70
S25	25	1.40	1.70	2.00
S30	30	1.70	2.00	2.30
S35	35	2.00	2.30	2.60
S40	40	2.30	2.60	2.90
S50	50	2.90	3.20	3.50

MALE CONNECTOR

Male with Socket Connector 1.0" x 1.0"

Part No.	No. of Connectors	1.0	1.5	1.8
M20	20	0.40	0.50	0.60
M25	25	0.50	0.60	0.70
M30	30	0.60	0.70	0.80
M35	35	0.70	0.80	0.90
M40	40	0.80	0.90	1.00
M50	50	0.90	1.00	1.10

D-SUB CONNECTORS

Part No.	No. of Connectors	1.0	1.5	1.8
D20P	20 Pin	1.00	1.30	1.60
D25P	25 Pin	1.30	1.60	1.90
D30P	30 Pin	1.60	1.90	2.20
D35P	35 Pin	1.90	2.20	2.50
D40P	40 Pin	2.20	2.50	2.80
D45P	45 Pin	2.50	2.80	3.10
D50P	50 Pin	2.80	3.10	3.40
D55P	55 Pin	3.10	3.40	3.70
D60P	60 Pin	3.40	3.70	4.00
D65P	65 Pin	3.70	4.00	4.30
D70P	70 Pin	4.00	4.30	4.60
D75P	75 Pin	4.30	4.60	4.90
D80P	80 Pin	4.60	4.90	5.20
D85P	85 Pin	4.90	5.20	5.50
D90P	90 Pin	5.20	5.50	5.80
D95P	95 Pin	5.50	5.80	6.10
D100P	100 Pin	5.80	6.10	6.40

36-Pin CENTRONICS RIBBON CONNECTORS

Part No.	No. of Connectors	1.0	1.5	1.8
C20	20	0.80	1.10	1.40
C25	25	1.10	1.40	1.70
C30	30	1.40	1.70	2.00
C35	35	1.70	2.00	2.30
C40	40	2.00	2.30	2.60
C50	50	2.60	2.90	3.20

28-AWG FLAT GREY CABLE

Part No.	No. of Connectors	1.0	1.5	1.8
F20	20	0.80	1.10	1.40
F25	25	1.10	1.40	1.70
F30	30	1.40	1.70	2.00
F35	35	1.70	2.00	2.30
F40	40	2.00	2.30	2.60
F50	50	2.60	2.90	3.20

28-AWG FLAT GREY CABLE

Part No.	No. of Connectors	1.0	1.5	1.8
F20	20	0.80	1.10	1.40
F25	25	1.10	1.40	1.70
F30	30	1.40	1.70	2.00
F35	35	1.70	2.00	2.30
F40	40	2.00	2.30	2.60
F50	50	2.60	2.90	3.20

CUSTOM ASSEMBLIES

Use the part numbers from the connectors and cables to order your own custom assembled cables.

Example: 10' of 28-AWG Flat Grey Cable with 20 Pin Centronics connector on one end and 25 Pin Centronics connector on the other and you would order:

28-AWG Flat Grey Cable 10' \$10.00

20 Pin Centronics Connector \$1.00

25 Pin Centronics Connector \$1.00

Total \$12.00

28-AWG FLAT GREY CABLE

Part No.	No. of Connectors	1.0	1.5	1.8
F20	20	0.80	1.10	1.40
F25	25	1.10	1.40	1.70
F30	30	1.40	1.70	2.00
F35	35	1.70	2.00	2.30
F40	40	2.00	2.30	2.60
F50	50	2.60	2.90	3.20

CUSTOM ASSEMBLIES

Use the part numbers from the connectors and cables to order your own custom assembled cables.

Example: 10' of 28-AWG Flat Grey Cable with 20 Pin Centronics connector on one end and 25 Pin Centronics connector on the other and you would order:

28-AWG Flat Grey Cable 10' \$10.00

20 Pin Centronics Connector \$1.00

25 Pin Centronics Connector \$1.00

Total \$12.00

ACCESSORIES FOR APPLE* COMPUTERS

Numeric/Auxiliary Keypad for APPLE IIe*

Computer Keyboard

JE614 Assembled and Tested \$89.95

Extended 80 Column/64K RAM Card for APPLE IIe*

JE684 Assembled and Tested \$149.95

Switching Power Supply for APPLE II, II+, and IIx*

JE614 Assembled and Tested \$89.95

Cooling Fan for APPLE II, II+, and IIx*

JE684 Assembled and Tested \$149.95

POWER SUPPLY +5VDC @ 7.5 AMP, 12VDC @ 1.5 AMP SWITCHING

Input: 115VAC 50-60Hz Output: 5VDC @ 7.5Amp, 12VDC @ 1.5Amp

Part No. PS94YDS \$39.95 each

POWER SUPPLY 4-Channel Switching - Apple Compatible

Microprocessor, item-ordering terminal, medical equipment and process control applications

Part No. PS94YDS \$39.95 each

POWER SUPPLY +5VDC @ 7.5 AMP, 12VDC @ 1.5 AMP SWITCHING

Input: 115VAC 50-60Hz Output: 5VDC @ 7.5Amp, 12VDC @ 1.5Amp

Part No. PS94YDS \$39.95 each

POWER SUPPLY 4-Channel Switching - Apple Compatible

Microprocessor, item-ordering terminal, medical equipment and process control applications

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POWER SUPPLY +5VDC @ 7.5 AMP, 12VDC @ 1.5 AMP SWITCHING

Input: 115VAC 50-60Hz Output: 5VDC @ 7.5Amp, 12VDC @ 1.5Amp

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POWER SUPPLY +5VDC @ 7.5 AMP, 12VDC @ 1.5 AMP SWITCHING

Input: 115VAC 50-60Hz Output: 5VDC @ 7.5Amp, 12VDC @ 1.5Amp

Part No. PS94YDS \$39.95 each

POWER SUPPLY 4-Channel Switching - Apple Compatible

Microprocessor, item-ordering terminal, medical equipment and process control applications

Part No. PS94YDS \$39.95 each



JE664 EPROM PROGRAMMER

8K TO 64K EPROMS - 24 AND 28 PIN PACKAGES

Programs, updates and checks for properly erased EPROMs • Emulates PROMs in EPROMs • JE664's Computer interface for off-line programming loading • Erases data from RAM by keyboard • Changes data in RAM by keyboard • Loads EPROM data into EPROMs • Emulates EPROMs for control interface • Loads EPROMs • Power supply: 115VAC, 60Hz • 10W power consumption • Excellent case-coordinated, light blue painted • modular design • Size 5 1/2" x 8 1/2" x 1 1/2" • 8 1/2" x 1 1/2" x 1 1/2"

JE664-A EPROM Programmer \$995.00

JE665 - RS232C INTERFACE OPTION - The JE665 RS232C interface connects computer access to the JE664's RAM. Sample software written in BASIC provided for RS232C Mode - Level B Computer - Based rate: 9600 baud rate. 8 and 1600 baud rates. 2 options may be selected in other computers. The JE665 can be used with any computer with an RS232C port. Information is also provided for interfacing to any CP/M system with an RS232C port.

JE664-ARS EPROM Programmer + JE665 Option \$1195.00

PIN	EPROM	EPROM MANUFACTURER	PRICE
JM160A	7708	AMD Motorola National Rec TI (25V)	\$14.95
JM160A	7718 TM52516	Intel Motorola National Rec TI (25V)	\$14.95
JM160	7708	Motorola TI (25V)	\$14.95
JM160	7718 TM52516	Motorola TI (25V)	\$14.95
JM160	7708	AMD Fujitsu NEC Intel (25V)	\$14.95
JM160	7718 TM52516	Intel (25V)	\$14.95
JM160	7708	Motorola TI (25V)	\$14.95
JM160	7718 TM52516	Intel (25V)	\$14.95
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UV-EPROM Eraser

8 Chips - 51 Minutes

1 Chip - 37 Minutes

Erases 2708, 2716, 2732, 2764, 2516, 2532, 2564. Erases up to 8 chips within 81 minutes (1 chip in 37 minutes). Maintains constant exposure distance of one inch. Special conductive foam liner eliminates static build-up. Built-in safety lock to prevent UV exposure. Compact - only 8 1/2" x 3 1/2" x 2 1/2". Complete with holding tray for 8 chips.

DE-4 UV-EPROM Eraser \$79.95

UVS-11EL Replacement Bulb \$16.95

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• Used Seagate ST506 mechanical • 143K formatted storage • 30 tracks • compatible with Apple controller • Complete with connector and cable • Just plug into your disk controller • Size 8 1/2" x 5 1/2" x 1 1/2" • Weight 4 lbs

Part No. A00-514 \$195.95

8" FLOPPY DISK DRIVE

8" FLOPPY DISK DRIVE

• Shugart 801R compatible • Single-Sided • 77 Tracks • 400/800K Bytes Capacity • Industry Standard

FDD100-8

The FDD100-8 8" Floppy Disk Drive (Industry Standard) features single or double density. Recording mode: FM single, FM double density. Transfer rate: 250K bits/sec. Single density: 500K bits/sec. Double density: 1000K bits/sec. The FDD100-8 is designed to work with the single sided soft sector IBM (Diastats) or eq. disk cartridge. Power: 110VAC @ 60-60Hz. 24VDC @ 1.7 Amps. 5VDC @ 1.2 Amps. max. Input as pictured above (does not include case, power supply, or cables). Size 8 1/2" x 14 1/2" x 4 1/2". Weighs 12 lbs. incl. 96 pg. manual.

Part No. FDD100-8 \$169.95 ea.

IBM MEMORY EXPANSION KIT

SAVE HUNDREDS OF \$\$\$ BY UPGRADING MEMORY BOARDS YOURSELF!

Most of the low popular memory boards allow you to add an additional 64K, 128K, 192K, or 256K. The IBM64K kit will populate these boards in 64K byte increments. The kit is simple to install - just insert the nine 64K RAM chips in the provided sockets and set the two groups of switches. Directions are included.

IBM64K (Nine 200ns 64K RAMs) \$49.95

EXPAND YOUR MEMORY

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Model 3	From 4K to 48K Requires (3) Three Kits	
Model 4	From 4K to 16K Requires (1) One Kit	
Model 1	Scrapped with Expansion Board to Add Two Kits Required	
Model 3	Scrapped with Expansion Board to Add Two Kits Required	
Model 4	Scrapped with Expansion Board to Add Two Kits Required	
TRS-16K3	*200ns for Color & Model III	\$12.95
TRS-16K4	*250ns for Model I	\$19.95
TRS-80 Color 32K or 64K Conversion Kit		
Easy to install kit comes complete with 1 set of 4164-2 (200ns) 64K dynamic RAMs & conversion documentation. Converts TRS-80 color computers with 8 circuit boards, 4 1/2 hour color computers to 32K. Minor modifications of 32K memory will allow the use of all the 64K of the dynamic RAM providing you have a FLEX DOS operating system.		
TRS-64K2		\$44.95

Listing 9 continued

```

00476 LD A,(HL) ;get char from search key buffer
00477 INC HL ;pt to next char in search key buffer
00478 CP 00H ;EOR? (end of search key?)
00479 JP 2,SYNEND ;exit loop if end of key
00480 CP 253 ;
00481 JR 1,SYN0P ;
00482 CP 254 ;
00483 JR 2,SYN0P ;
00484 INC C ;
00485 JR SYMPL ;
00486 SYMPL LD A,3 ;key terminated by operand
00487 CP C ;was key >= 3?
00488 JR 2,SYNRET ;key len = 3, so get next key
00489 N,SYNRET ;key len > 3 so get next key
00490 SYMRET LD BC,3*256 ;syntax error (key < 3 char)
00491 CALL POSCUR ;rc1cl
00492 CALL ERASES ;erase to end of screen
00493 HL,THREE ;Each key must be three or more char's
00494 CALL VDLNE ;
00495 CALL TAPENT ;Tap enter to continue
00496 LD A,0 ;
00497 RPT ;
00498 SYMEND LD A,3 ;A#0 => had syntax
00499 CP C ;end of key(s) reached
00500 JR 2,SYNRET ;check that last key >= 3
00501 CP N,SYNRET ;
00502 SYMRET JR SYNER ;key < 3 so jp cc error msg
00503 LD A,1 ;
00504 RET ;A=1 => proper syntax
;-----
00505 ;HASHKEY
00506 ;-----
00507 ;hash search key
00508 ;search key in KEYBUF
00509 ;triplet hash codes stored in HSHBUP
00510 ;see H3 (index program) for hash algo.
00511 ;entry: no parameters passed
00512 ;result: len of hash code stored in MDLEN
00513 ;reg altered: AF, BC, DE, HL, IX, Y
00514 ;C = key len
00515 HSHKEY LD C,H ;
00516 LD IX,HSHBUP ;IX -> search key signature buffer
00517 LD IX,KEYBUF ;IX -> search key buffer
00518 HSH3 LD L,(IX-0) ;get char from search key
00519 LD H,0 ;HL contains char
00520 LD A,L ;
00521 CP 00H ;end of string?
00522 JP 1,HSHE ;if EOR then end hashing
00523 CP ' ' ;blank?
00524 JR NZ,HS4 ;continue at HSH if not blank
00525 INC IX ;pt to next char
00526 JR HSH3 ;loop until non-blank char reached
00527 ;now get first 2 char of key.
00528 HSH4 CALL MURL10 ;mult value in HL by 10
00529 LD HL,(MYTE),HL ;store in MYTE
00530 INC IX ;pt to next char in search key
00531 LD L,(IX-0) ;
00532 LD H,0 ;
00533 LD HL,(LBYTE),HL ;store value of char in LBYTE
00534 INC IX ;pt to next char in search key
;-----
00535 ;HSHLP
00536 ;-----
00537 ;
00538 ;
00539 HSHLP LD HL,(MYTE) ;get triplet and hash it
00540 CALL HL10 ;get 10ac1
00541 LD HL,"BITE",HL ;smult by 10
00542 ;store 10ac1
00543 ;
00544 ;
00545 HSH4 LD HL,(LBYTE) ;get ac3
00546 CALL MURL10 ;smult by 10
00547 LD HL,(RBYTE),HL ;store 10ac2
00548 ;
00549 ;
00550 HSH5 LD A,(IX-0) ;get char (cl) from search key
00551 INC IX ;inc IX to next char
00552 CP 00H ;EOR?
00553 JP 1,HSR3 ;skip 3 hashes
00554 CP 253 ;and op?
00555 JR 2,HSR5 ;or op?
00556 CP 254 ;
00557 JR HSR6 ;
00558 HSR5 LD HL,(Y#0),A ;store op in hash buffer
00559 INC Y ;pt to next byte in hash buffer
00560 INC C ;inc hash buf len counter
00561 JP HSR3 ;loop until end of search key
;-----
00562 ;HSH6
00563 ;-----
00564 ;hash triplet
00565 ;
00566 HSH6 LD L,A ;
00567 LD H,0 ;
00568 LD HL,(LBYTE),HL ;
00569 LD DE,(MYTE) ;
00570 ADD HL,DE ;10ac2*ac3
00571 LD DE,(RBYTE) ;
00572 HL,DE ;
00573 LD A,251 ;10ac1 + (10ac2*ac3)
00574 CALL DIVIDE ;A has modulo 251 result
00575 LD HL,(IX-0),A ;store hash code
00576 INC C ;inc hash code len
00577 INC Y ;
00578 JP HSHLP ;loop until end of search key(s)
;-----
00579 ;HSH8
00580 ;-----
00581 ;hashing complete
00582 LD A,C ;save hash len
00583 LD HL,(NDESH),A ;
00584 RET ;
00585 ;
00586 MUAL0 NOF ;mult 0 in A by 10
00587 ;BC and DE used
00588 ;value returned in HL
00589 LD H,0 ;
00590 LD L,A ;
00591 MURL10 MOP ;multiply 0 in HL by 10
00592 LD HL,HL ;HL contains 2*no.
00593 LD L,0 ;
00594 LD D,H ;
00595 ADD HL,HL ;4
00596 ADD HL,HL ;8
00597 ADD HL,DE ;10
00598 RET ;
00599 ;-----
00600 ;GETSEC
00601 ;-----
00602 ;get sector from source file
00603 ;entry: no para
00604 ;result: sector from disk in INBUF
00605 ;reg altered: AF,BC,DE,HL
00606 GETSEC LD HL,INBUF ;pt to source file rec buf
00607 DEC HL ;HL->last char of record before INBUF
00608 LD A,(HL) ;last byte of SINBUF
00609 LD HL,DE ;save this byte for analysis of records
00610 ;that span sector
00611 ;
00612 PUSH IX ;
00613 POP BC ;BC -> input rec to read
00614 LD (CERN),BC ;store current LBN
00615 CALL READ2 ;read two sectors from src file
00616 CALL SECTOR ;
00617 RET ;
;-----
00618 ;SECTOR
00619 ;-----
00620 ;searches records in sector for key(s)
00621 ;starts with remaining rec in SINBUF
00622 ;and reads across into INBUF
00623 ;
00624 SECTOR CALL NEWSEC ;
00625 LD DE,(LBRN) ;
00626 INC DE ;
00627 LD HL,(CLRN) ;

```

```

00629 LD (LLRN),HL ;LLRN will be next LLRN
00629 EX DE,HL ;is this needed?
00630 LD B,A
00631 XOR A ;carry = 0
00632 LD A,A ;restore A
00633 SBC HL,DE
00634 JP NZ,SECLP3
00635 LD A,(B256)
00636 CF 00H ;EOR?
00637 JP 1,SECLP3 ;if BOR then read 1st rec
00638 CPZJ2 CP ZOR ;if BOR then read 1st rec
00639 JR 1,SECLP3
00640 SECLP RESTSC
00641 SECLP3 CP 0
00642 JP 1,ENDSEC
00643 CALL SK ;scan for keys
00644 LD A,(HIT)
00645 B 0 ;check if key found
00646 JR 1,SECLP ;loop until key found
00647 SECLP4 NOP
00648 SECLP6 LD RE,RETBUP
00649 CALL DDP ;display record
00650 CP BRKKEY ;break?
00651 JP 1,ENDSEC ;RET if break
00652 CP '1' ;1st cmd?
00653 JR NZ,SECLP ;1st routine
00654 CALL LIST
00655 CP BRKKEY ;no dotted line if bck
00656 RET 3
00657 CALL NEWLN
00658 CALL OE1NE
00659 CALL NEWLN
00660 ENDSEC RET
;-----
00661 ;NEWSEC
;-----
00662 ;transfers logical rec from SINBUF to RECBUF
;entry: NEXTREC = byte in SINBUF that is start
; of next logical rec
;exit: A=0 no more records
; A=1 more logical records
; NEXTREC = byte in SINBUF that is start
; of next log rec
00663 ;reg altered: AF,BC,DE,HL
00664 ;next sector so NEXTREC -> start of SINBUF
00665 LD HL,SINBUF
00666 LD (NEXTREC),HL
00667 LD DE,RECBUF
00668 JR SKIP
00669 LD HL,INBUF
00670 LD DE,(NEXTREC)
00671 OR A ;set carry = 0
00672 SBC HL,DE
00673 JP NZ,MOREREC ;no more rec in pt'd sec
00674 JP 1,MOREREC
00675 LD HL,(NEXTREC)
00676 LD DE,RECBUF
00677 OR A
00678 SBC HL,DE
00679 LD BC,0
00680 LD A,256
00681 INC C
00682 INC BC
00683 LD A,256
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00685 LD A,256
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Listing 9 continued

Model 4

Plus

- 64K Ram
- 2 Tandem Drives
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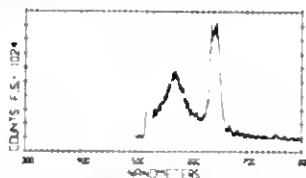
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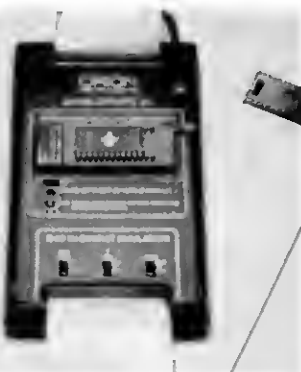
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Complete instructions and sample schematics are included to help you design your own simple stand-alone microcomputer systems. THESE SYSTEMS CAN BE AS SIMPLE AS FOUR ICs: one TTL circuit for clock and reset, a Z-80, an EPROM, and one peripheral interface chip.

When the In-Circuit-Emulation cable is plugged into the Z-80 socket of your stand-alone system, the system becomes a part of your TRS-80. You can use the full power of your editor/assembler's debug and trace program to check out both the hardware and the software. Simple test loops can be used to check out the hardware, then the system program can be run to debug the logic of your stand-alone device.

Since the program is kept in TRS-80 RAM, changes can be made quickly and easily. When your stand-alone device works as desired, you use the Developmate's PROM PROGRAMMER to copy the program into a PROM. With this PROM, and a Z-80 in place of the emulation cable, your stand-alone device will work by itself.

The DEVELOPMATE is extremely compact: Both the PROM programmer and the In-Circuit-Emulator are in one small plastic box only 3 1/2" x 5 1/4". A line-plug mounted power supply is included. The PROM programmer has a "personality module" which defines the voltages and connections of the PROM so that future devices can be accommodated. However, the system comes with a "universal" personality module which handles 2758, 2508 (8K), 2716, 2516 (16K), 2532 (32K), as well as the new electrically alterable 2816 and 48016 (16K EEPROMs).

The COMPLETE DEVELOPMATE 81, for Model I, with software, power supply, emulation cable, TRS-80 cable, and "universal" personality module \$329

DEVELOPMATE 83, Model III/4 version,
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2732A EPROM \$15
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2764 EPROM \$15

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Listing 9 continued

```

00780      GTRYWD LD    BL,(HKEYT)
00781      LD    08,STY
00782      WTCBAS LD    A,(HL)
00783      CP    00H
00784      JF    Z,ENDKEY
00785      CP    253
00786      JF    Z,ANDEND
00787      CP    356
00788      JF    Z,OREND
00789      LD    (DE),A
00790      INC    HL
00791      INC    DE
00792      JF    WTCBAS
00793      JF    WTCBAS
00794      JF    WTCBAS
00795      JF    WTCBAS
00796      JF    WTCBAS
00797      JF    WTCBAS
00798      LD    (DE),A
00799      INC    HL
00800      INC    DE
00801      JF    WTCBAS
00802      JF    WTCBAS
00803      ANDEND INC    HL
00804      LD    (HKEYT),HL
00805      LD    A,00H
00806      LD    10H,A
00807      LD    A,0
00808      LD    (WTCBAS),A
00809      LD    A,1
00810      JF    WTCBAS
00811      OREND INC    HL
00812      LD    (HKEYT),HL
00813      LD    A,00H
00814      LD    (DE),A
00815      LD    A,1
00816      LD    (WTCBAS),A
00817      RET
00818      BORETS LD    (DE),A
00819      LD    A,1
00820      LD    (HKEYT),A
00821      RET
00822      JF    WTCBAS
00823      JF    WTCBAS
00824      JF    WTCBAS
00825      JF    WTCBAS
00826      JF    WTCBAS
00827      JF    WTCBAS
00828      JF    WTCBAS
00829      JF    WTCBAS
00830      JF    WTCBAS
00831      JF    WTCBAS
00832      JF    WTCBAS
00833      JF    WTCBAS
00834      SKT00R LD    HL,(HKEYT)
00835      LD    A,(HL)
00836      CP    00H
00837      JF    Z,ST4
00838      CP    254
00839      JF    Z,ST5
00840      INC    HL
00841      JF    ST2
00842      LD    A,0
00843      RET
00844      ST5 LD    A,1
00845      INC    HL
00846      LD    (HKEYT),HL
00847      LD    A,1
00848      LD    (OPER),A
00849      RET
00850      SKT6 LD    A,1
00851      LD    (OPER),A
00852      RET
00853      JF    WTCBAS
00854      JF    WTCBAS
00855      JF    WTCBAS
00856      JF    WTCBAS
00857      JF    WTCBAS
00858      JF    WTCBAS
00859      JF    WTCBAS
00860      JF    WTCBAS
00861      JF    WTCBAS
00862      JF    WTCBAS
00863      JF    WTCBAS
00864      JF    WTCBAS
00865      JF    WTCBAS
00866      JF    WTCBAS
00867      JF    WTCBAS
00868      JF    WTCBAS
00869      JF    WTCBAS
00870      JF    WTCBAS
00871      JF    WTCBAS
00872      JF    WTCBAS
00873      JF    WTCBAS
00874      JF    WTCBAS
00875      JF    WTCBAS
00876      JF    WTCBAS
00877      JF    WTCBAS
00878      JF    WTCBAS
00879      JF    WTCBAS
00880      JF    WTCBAS
00881      JF    WTCBAS
00882      JF    WTCBAS
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00884      JF    WTCBAS
00885      JF    WTCBAS
00886      JF    WTCBAS
00887      JF    WTCBAS
00888      JF    WTCBAS
00889      JF    WTCBAS
00890      JF    WTCBAS
00891      JF    WTCBAS
00892      JF    WTCBAS
00893      JF    WTCBAS
00894      JF    WTCBAS
00895      JF    WTCBAS
00896      JF    WTCBAS
00897      JF    WTCBAS
00898      JF    WTCBAS
00899      JF    WTCBAS
00900      JF    WTCBAS
00901      JF    WTCBAS
00902      JF    WTCBAS
00903      JF    WTCBAS
00904      JF    WTCBAS
00905      JF    WTCBAS
00906      JF    WTCBAS
00907      JF    WTCBAS
00908      JF    WTCBAS
00909      JF    WTCBAS
00910      JF    WTCBAS
00911      JF    WTCBAS
00912      JF    WTCBAS
00913      JF    WTCBAS
00914      JF    WTCBAS
00915      JF    WTCBAS
00916      JF    WTCBAS
00917      JF    WTCBAS
00918      JF    WTCBAS
00919      JF    WTCBAS
00920      JF    WTCBAS
00921      JF    WTCBAS
00922      JF    WTCBAS
00923      JF    WTCBAS
00924      JF    WTCBAS
00925      JF    WTCBAS
00926      JF    WTCBAS
00927      JF    WTCBAS
00928      JF    WTCBAS
00929      JF    WTCBAS
00930      JF    WTCBAS
00931      JF    WTCBAS

```

```

00932      CP    20
00933      JF    WTCBAS
00934      JF    WTCBAS
00935      JF    WTCBAS
00936      JF    WTCBAS
00937      JF    WTCBAS
00938      JF    WTCBAS
00939      JF    WTCBAS
00940      JF    WTCBAS
00941      JF    WTCBAS
00942      JF    WTCBAS
00943      JF    WTCBAS
00944      JF    WTCBAS
00945      JF    WTCBAS
00946      JF    WTCBAS
00947      JF    WTCBAS
00948      JF    WTCBAS
00949      JF    WTCBAS
00950      JF    WTCBAS
00951      JF    WTCBAS
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01010      JF    WTCBAS
01011      JF    WTCBAS
01012      JF    WTCBAS
01013      JF    WTCBAS
01014      JF    WTCBAS
01015      JF    WTCBAS
01016      JF    WTCBAS
01017      JF    WTCBAS
01018      JF    WTCBAS
01019      JF    WTCBAS
01020      JF    WTCBAS
01021      JF    WTCBAS
01022      JF    WTCBAS
01023      JF    WTCBAS
01024      JF    WTCBAS
01025      JF    WTCBAS
01026      JF    WTCBAS
01027      JF    WTCBAS
01028      JF    WTCBAS
01029      JF    WTCBAS
01030      JF    WTCBAS
01031      JF    WTCBAS
01032      JF    WTCBAS
01033      JF    WTCBAS
01034      JF    WTCBAS
01035      JF    WTCBAS
01036      JF    WTCBAS
01037      JF    WTCBAS
01038      JF    WTCBAS
01039      JF    WTCBAS
01040      JF    WTCBAS
01041      JF    WTCBAS
01042      JF    WTCBAS
01043      JF    WTCBAS
01044      JF    WTCBAS
01045      JF    WTCBAS
01046      JF    WTCBAS
01047      JF    WTCBAS
01048      JF    WTCBAS
01049      JF    WTCBAS
01050      JF    WTCBAS
01051      JF    WTCBAS
01052      JF    WTCBAS
01053      JF    WTCBAS
01054      JF    WTCBAS
01055      JF    WTCBAS
01056      JF    WTCBAS
01057      JF    WTCBAS
01058      JF    WTCBAS
01059      JF    WTCBAS
01060      JF    WTCBAS
01061      JF    WTCBAS
01062      JF    WTCBAS
01063      JF    WTCBAS
01064      JF    WTCBAS
01065      JF    WTCBAS
01066      JF    WTCBAS
01067      JF    WTCBAS
01068      JF    WTCBAS
01069      JF    WTCBAS
01070      JF    WTCBAS
01071      JF    WTCBAS
01072      JF    WTCBAS
01073      JF    WTCBAS
01074      JF    WTCBAS
01075      JF    WTCBAS
01076      JF    WTCBAS
01077      JF    WTCBAS

```

Listing 9 continued

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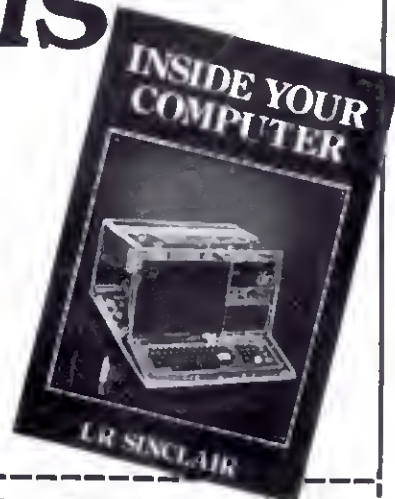
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Listing 9 continued

```

01078      CALL    DSPSNR
01079      POP      DE
01080      RET
-----
01082      ;SEMSG
01083      ;
01084      ;display 'Searching' msg
01085      SEMSG    PUSH    DE
01086      PUSH    HL
01087      CALL    HOME
01088      LD      HL,MSGSEA
01089      CALL    VDLINL
01090      CALL    NEWLN
01091      POP     HL
01092      POP     DE
01093      RET
-----
01095      ;MENU12
01096      ;
01097      ;mini-menu routine
01098      ;r1:c1
01099      MENU12   CALL    HOME
01100      MENU12   LD      HL,MSGM2
01101      CALL    VDLINL
01102      CALL    EWAIT
01103      ;A
01104      CP      'C'
01105      RET     Z
01106      CP      'O'
01107      JP     S,M2OPT
01108      CP      'P'
01109      JP     S,M2CHD
01110      CP      'R'
01111      JP     S,M2CHD
01112      LD      A,'O'
01113      RET
01114      M2CHD   PUSH    AF
01115      LD      A,(OFSTAT)
01116      CP      'C'
01117      JP     S,M2CHD3
01118      LD      DE,OUTDCB
01119      CALL    CLOSE
01120      CALL    VDLINL
01121      CALL    VDLINL
01122      POP     AF
01123      CP      'P'
01124      LD      HL,M2PCMD
01125      RET
01126      M2OPT   CALL    OPT
01127      LD      A,'O'
01128      RET
-----
01130      ;open output file
01131      OPNDOUT  LD      A,(OFSTAT)
01132      LD      A,'O'
01133      CP      'C'
01134      RET     Z
01135      LD      DE,OUTDCB
01136      LD      HL,OUTBUF
01137      LD      B,1
01138      CALL    OPINLT
01139      JP     S,OPNDOUT4
01140      PUSH    AF
01141      LD      B,PENULN
01142      LD      C,8
01143      CALL    POSCUR
01144      POP     AF
01145      CALL    ERSEP
01146      CALL    BOTTOM
01147      CALL    TAPENT
01148      LD      A,'C'
01149      LD      (OFSTAT),A
01150      RET
01151      OPNDOUT4 LD      A,'O'
01152      LD      (OFSTAT),A
01153      RET
-----
01155      ;paragraph format
01156      LD      A,255
01157      LD      HL,CP2E2
01158      INC     HL
01159      LD      (HL),A
01160      LD      HL,CP2E4
01161      INC     HL
01162      LD      (HL),A
01163      LD      (PSEB0),A
01164      LD      A,'L'
01165      LD      (SDMODE),A
01166      LD      HL,MSGPF
01167      CALL    VDLINL
01168      RET
-----
01170      ;record format
01171      RECFOR   LD      A,80H
01172      LD      HL,CP2E2
01173      INC     HL
01174      LD      (HL),A
01175      LD      HL,CP2E4
01176      INC     HL
01177      LD      (HL),A
01178      LD      (PSEB0),A
01179      LD      A,'R'
01180      LD      (SDMODE),A
01181      RET
-----
01183      ;display sector number
01184      DSPSNR   NOP
01185      PUSH    BC
01186      PUSH    DE
01187      PUSH    HL
01188      PUSH    IX
01189      PUSH    IY
01190      CALL    CURPOS
01191      LD      HL,(CURSOR),BC
01192      LD      BC,11
01193      CALL    POSCUR
01194      LD      HL,(IDCB0),A
01195      LD      DSPSNR
01196      LD      BC,(CURSOR)
01197      CALL    POSCUR
01198      LD      IY
01199      LD      IX
01200      LD      HL
01201      LD      DE
01202      LD      BC
01203      RET
-----
01204      ;last msg; no new storage
01205      ;beyond this point
01206      ;current MAP sector
01207      ;last msg page
01208      ;last msg byte
01209      ;total hash byte
01210      ;temp total hash byte
01211      ;hash word len
01212      ;1 -> key(s) found
01204      LSTSEC  DEFW    #
01205      CRSEC   DEFW    #
01206      NKTWAP  DEFW    #
01207      NAKMAP  DEFW    #
01208      TSTYTS  DEFB    #
01209      TSTYTS  DEFB    #
01210      TSTYTS  DEFB    #
01211      MOLEN   DEFB    #
01212      HIT     DEFB    #

```

Listing 9 continued

```

01213 KEYKEY DEFB 0 ;next key in SETBUF
01214 OPER DEFB 0 ;operation &and; l=or
01215 MTOP DEFB 0 ;next operation
01216 ENDKEY DEFB 0 ;i-and of keys reached

01217 CLRN DEFB 0 ;current LRN
01218 LLRN DEFB 0 ;last LRN
01219 SPWORD DEFB 0 ;(S)paca or (M)ord
01220 BOP DEFB 0
01221 MODE DEFB 0 ;list or search mode
01222 SOWORD DEFB 0 ;search display mode: line,rec,all
01223 DEFB 0 ;SRTA
01224 PRMODE DEFB 'A' ;output mode (C)ontinuous or (M)anual
01225 OFCMD DEFB 'C' ;output filter (C)lose, (R)eset or (A)ppend
01226 OFSTAT DEFB 'C' ;output file status: (C)losed or (O)pen

01227 CNOOB DEFB 'M' ;output mode (C)ontinuous or (M)anual
01228 B256 DEFB 0 ;storage last byte SIBBUF
01229 LINEIN DEFB 0 ;line number for D&P
01230 BINSET DEFB 2 ;no. of spaces to inset
01231 SINSET DEFB 0 ;storage for inset
01232 PSOR DEFB 0DH ;pseudo BOP
01233 ;;;
01234 CPFILE DEFB 0 ;current file name xxxxxxxx
01235 MXTREC DEFB 0 ;abs position of next rec
01236 SIBBUF DEFB 256

01237 INBUF DEFB 255 ;second source buf
01238 INBUF2 DEFB 0 ;byte 256 of INBUF
01239 INBUF3 DEFB 0DH ;end of record mark
01240 RECBUF DEFB 256 ;
01241 DEFB 0 ;BOP mark
01242 MAPBUF DEFB 256 ;
01243 DEFB 0 ;
01244 OUTBUF DEFB 256 ;output buffer
01245 DEFB 0 ;
01246 OFNAME DEFB 0 ;output file name

01247 DEFB 0 ;
01248 DEFB 0DH ;
01249 HSBUFF DEFB 0 ;
01250 KEYBUF DEFB 0 ;
01251 DEFB 0 ;
01252 DEFB 0 ;extra space if needed!!
01253 DEFB 0 ;
01254 DEFB 0 ;
01255 XSGPF DEFB 'Paragraph Format' ;
01256 DEFB 0 ;
01257 XSGRF DEFB 'Record Format' ;
01258 DEFB 0 ;
01259 XSGOP DEFB 'FILES OPENED' ;
01260 DEFB 0 ;

01261 XSGOPF DEFB 'END OF FILE' ;
01262 DEFB 0 ;
01263 MAPCMD DEFB 'MAP' ;
01264 DEFB 0 ;
01265 COOB DEFB 'INDEX 1.2' ;
01266 DEFB 0 ;
01267 TITLE DEFB 'MAP SEARCH PROGRAM 1.2' ;
01268 DEFB 0 ;
01269 CPMG DEFB '(c) Copyright 1983 Software!' ;
01270 DEFB 0 ;

01271 THREE DEFB 'Each key must contain at least three ' ;
01272 DEFB 'characters' ;
01273 DEFB 0 ;
01274 MSGHAM DEFB 'File Name: ' ;
01275 DEFB 0 ;
01276 FWEREG DEFB 'Error in file name format' ;
01277 DEFB 0 ;
01278 MSGM DEFB '(C)hange File; (M)AP; (O)ptions or (T)RSDOS: ' ;
01279 DEFB 0 ;
01280 MAPRD DEFB 'MAP READ COMPLETE' ;

01281 DEFB 0 ;
01282 MSGKEY DEFB 'Enter Key ' ;
01283 DEFB 0 ;
01284 MSGREA DEFB 'Searching ' ;
01285 DEFB 0 ;
01286 QINSET DEFB 'Inset ' ;
01287 DEFB 0 ;
01288 CURSOR DEFB 0 ;cursor position
01289 ;-----
01290 ;buffers used by 81

01291 ;-----
01292 ;general purpose variables
01293 ANSWER DEFB 0 ;some byte key in variable (Y/N etc)
01294 CNDLFS DEFB 0 ;cmd line file spec (Y/N)
01295 ;-----
01296 ;indicates whether file spec
01297 ;was entered along with RIMDEX cmd
01298 ;hash routine variables
01299 FBYTE DEFB 0 ;hash value of first byte of triplet
01300 MBYTE DEFB 0 ;hash value of middle byte of triplet
01301 LBYTE DEFB 0 ;hash value of last byte of triplet

01302 SCROSS DEFB 0 ;sector cross variable
01303 ;if 0 then sector boundary is not
01304 ;crossed by a record
01305 ;if >0 then the value in SCROSS
01306 ;is equal to the no of bytes in record
01307 ;prior to end of sector
01308 BICT DEFB 1 ;bit points to sector (0 to 7)
01309 ;-----
01310 ;HEADER buffer

01311 ;byte label purpose
01312 ;0-9 BSEC 'INDEX' and version
01313 ;10-19 BDN
01314 ;20-29 BSECPY format; BDN record
01315 ;30-39 BSECPY ' paragraph
01316 ;40-49 BDN blank (for future use)
01317 ;50-59 BDN source file spec
01318 ;-----
01319 END BEGIN

```

Program Listing 10. Assembly-language listing of S30OPEN/SRC.

```

Ln # Source Line
00001 ;S30OPEN/SRC VERSION 1.2
00002 ;Jun 9, 1983
00003 ;-----
00004 ;SEARCH INFORMATION RETRIEVAL PROGRAM
00005 ;ROUTINE TO OPEN FILES
00006 ;COPYRIGHT 1983, SOFTWARE CORPORATION ALL RIGHTS RESERVED
00007 ;-----
00008 S30OPEN PSECT ;begin relocatable program section

```

Listing 10 continued

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```

00099 PUBLIC GETFILE ;gets file specs
00100
00101
00102 EXTERN CFILE ;current file name
00103 EXTERN CNDLFS ;cmd line file spec (Y/N)
00104 ;indicates whether file spec also entered
00105 ;along with SEARCH cmd
00106
00107 EXTERN CODE
00108 EXTERN INBUF ;input (source) file record buffer
00109 EXTERN KEYBUF ;keybuf used to enter MINDEX file spec
00110
00111 EXTERN LSTSRC
00112 EXTERN MAXMAP
00113 EXTERN MENU28
00114 EXTERN MXTMAP
00115 EXTERN OFNAME
00116 EXTERN PARFOR
00117 EXTERN RECFOR
00118
00119
00120 ;calls to MODII or MODIII
00121
00122 EXTERN BOTTOM ;position cursor to last line of screen
00123 EXTERN CLOSE ;close file (DE->DCB)
00124 EXTERN CURSOR ;determine cursor pos (color:BC)
00125 EXTERN DISERR ;disable break (for Model II)
00126 EXTERN DIVIDE ;divide A into HL
00127 EXTERN DOSCMD ;j/p to TRSDOS and execute command
00128 EXTERN ERASEL ;erase to end of line
00129 EXTERN ERASES ;erase to end of screen
00130 EXTERN ERASDP ;MAP error display routine
00131 EXTERN ERROR ;TRSDOS error msg routine
00132 EXTERN HOME ;position cursor to top line of screen
00133 EXTERN INIT ;initialize file (create/open, pos to 1st rec)
00134 ; (DE->DCB, HL->rec buf)
00135
00136 EXTERN JPDOS ;j/p to TRSDOS
00137 EXTERN KBCNAB ;get char (or null) from keyboard
00138 EXTERN KBNLIT ;initialize keyboard (Mod II)
00139 EXTERN KBLINE ;get line from keyboard and end with $
00140 EXTERN KBLING ;get line from keyboard and end with $OH
00141 EXTERN KEMAIT ;wait for char from keyboard
00142 EXTERN KEYIB ;get search key(s) from keyboard
00143 EXTERN MOVEIN ;move line from screen to buffer
00144
00145 EXTERN NEWLIN ;HL->buf, B=no, char, BC=cursor color
00146 EXTERN OPEN ;open file (DE->DCB, HL->record buffer)
00147 EXTERN OPINIT ;open and initialize file
00148 ; (DE->DCB, HL->record buffer)
00149
00150 EXTERN POSCUR ;position cursor (coordinates in BC)
00151 EXTERN POSEOP ;position to end of file
00152 EXTERN POSM ;position to record in file
00153 EXTERN PRINTL ;initialize printer
00154 EXTERN PRINTL ;print line (HL->buf, B=no, char, C=end char)
00155 EXTERN PRSCRN ;print entire screen
00156 EXTERN PRTLN ;print last line of text
00157 EXTERN PRTRC ;print current record
00158 EXTERN READER ;read file's direct access
00159 EXTERN SETLRE ;set INLR to true last record
00160 EXTERN SETMLR ;set MAPLIR to true last record
00161 EXTERN STMRD ;store top of memory in MEMRD
00162 EXTERN VDCNAR ;display char in A register
00163 EXTERN VDCLES ;clear screen
00164 EXTERN VDLNIT ;initialize video I/O (for Model II)
00165 EXTERN VDLNLS ;display line (HL->msg)
00166 EXTERN WRITOK ;write next record to file
00167
00168 ;MODII/III buffers and I/O parameters
00169
00170 EXTERN INDCB ;Input (source) file DCB
00171 EXTERN INDCBL ;input file DCB Record Length
00172 EXTERN INDCBR ;input file DCB Current Record
00173 EXTERN INDCBLR ;input file DCB Last Record
00174 EXTERN INCLR ;true last record of source file
00175 EXTERN INDCBRS ;input file DCB xxxxxx
00176 EXTERN MAPDCB ;MAP (index) file DCB
00177 EXTERN MAPDCBL ;MAP file DCB Record Length
00178 EXTERN MAPDCBR ;MAP file DCB Current Record
00179 EXTERN MAPDCBLR ;MAP file DCB Last Record
00180 EXTERN MAPLIR ;true last record of index file
00181 EXTERN MAPDCBRS ;MAP file DCB xxxxxx
00182 EXTERN MEMRD ;contents -> top of memory
00183 EXTERN OUTCHR ;record buffer (1 byte) for output file
00184 EXTERN OUTDCB ;output file DCB
00185 EXTERN OUTBUF ;printer buffer (88 char)
00186 EXTERN SORLIN ;start of record line no.
00187 EXTERN STWAP ;start of MAP index file (always last byte
00188 ; of SEARCH program)
00189
00190 ;I/O parameters:
00191
00192 EXTERN ARROWD ;down arrow
00193 EXTERN ARROWL ;left arrow
00194 EXTERN ARROWR ;right arrow
00195 EXTERN ARROWU ;up arrow
00196 EXTERN BRKKEY ;break key value
00197 EXTERN CPYPOS ;copyright notice position (52 or 36)
00198 EXTERN PENULN ;reat to last line on screen (23 or 15)
00199 EXTERN SWIDTH ;screen width (88 or 64)
00200
00201 ;cells to GR (general routines)
00202
00203 EXTERN APPEND ;append on string to another
00204 EXTERN BXDEC ;binary to decimal conversion
00205 EXTERN DECSL ;decimal to binary conversion
00206 EXTERN DCLINE ;display dotted line (e.g. ....)
00207 EXTERN DSPMRD ;display 5-digit decimal no. (right justified)
00208 EXTERN DSPMBL ;display 5-digit decimal no. (left justified)
00209 EXTERN EATNLE ;removes leading blanks
00210 EXTERN FSPC ;inserts cmd line file spec to KEYBUF
00211 EXTERN GETMFR ;get MAP file names
00212 EXTERN LINE ;display line (from char in A reg)
00213 EXTERN PACKFS ;pack (compress) file spec in fixed table
00214 EXTERN PASCFC ;parse one file spec
00215 EXTERN RECIN ;retrieve 256-byte record
00216 EXTERN RECBL ;blank-out 256-byte record
00217 EXTERN TAPENT ;Tap enter to continue
00218
00219 ;GR buffers
00220
00221 EXTERN SNAM,SEXT,SPSW,SDDR ;source file table
00222 EXTERN INAR,LEXT,IPSW,IDDR ;index file table
00223 EXTERN ONAR,OXET,OPSW,ODDR
00224
00225
00226 GETFILE LD DE,MAPDCB ;just in case file open
00227 CALL CLOSE
00228 LD DE,INDCB ;just in case file open
00229 CALL CLOSE
00230 LD BC,256
00231 CALL POSCUR ;file
00232 CALL ERASES ;erase to end of screen
00233 LD BC,256
00234 CALL POSCUR ;file
00235 LD HL,MSGNAM ;'File Name:' msg
00236 CALL VDLNLS
00237 LD B,PENULN
00238 LD C,$
00239 CALL POSCUR ;1st col, next to last row
00240 LD HL,MSG2 ;'Enter file name, or ? for help'
00241 CALL VDLNLS
00242
00243 LD A,(CNDLFS) ;command line file spec(s)
00244 CP 'Y' ;where file spec given on cmd line?
00245 JR NZ,GETFILE ;j/p to GETFILE if not given
00246 LD BC,256+11 ;14C12
00247 CALL POSCUR ;increase file spec on cmd line was in error
00248 LD A,'$' ;and program needs to loop back to get
00249 LD (CNDLFS),A ;file spec in which case the CNDLFS = N
00250 ;turn off auto file spec
00251
00252 LD HL,KEYBUF ;file spec entered on cmd line
00253 CALL VOLINE ;dsp file spec
00254 LD A,$OH
00255 CP A
00256 LD B,1
00257 JR GETAUTO ;j1 (sec)
00258 ;jso rec length not = 0
00259
00260 ;GETFILE
00261
00262 ;file spec not entered on cmd
00263 ;or invalid file spec form cmd
00264 ;so get file spec
00265 ;14C12
00266
00267 ;erase to end of line
00268 ;no more than 51 char in file spec
00269 ;use KEYBUF to hold file spec
00270 ;key in file spec
00271 ;was break bit?
00272 ;j/p to GETFIL if break not pressed
00273
00274 LD BC,256
00275 CALL POSCUR ;13:cl
00276 CALL ERASES ;erase to end of screen
00277 CALL MENU28 ;recall main-menu
00278 CP 'M' ;(M)AP?
00279 JP 1,DOSCMD ;j/p to TRSDOS and load MAP
00280 CP 'T' ;(T)RSDOS?
00281 JP 1,PDOS ;j/p to TRSDOS
00282 CP 'J' ;j/p back and get file name
00283
00284 LD C,B ;B = no. of char's keyed in with KBLINE
00285 LD A,C
00286 CP 0
00287 JR NZ,GETFIL ;null entry so loop and get name again
00288
00289 ;GETFILE4
00290
00291 ;file spec now in KEYBUF
00292 ;now process it
00293
00294 LD HL,KEYBUF
00295 CALL ERASEL ;remove leading blanks if any
00296 LD A,(HL)
00297 CP '7' ;was 7 (for help) entered?
00298 JP NZ,MHELP ;j/p to MHELP (mainhelp screen)
00299 LD HL,KEYBUF ;j/p to KEYBUF again
00300 CALL GETMFR ;get file names
00301 JR FNOK ;j/p FNOK if file spec OK
00302 LD BC,8*256 ;load file specs
00303 CALL POSCUR ;13:cl
00304 CALL ERASES ;erase to end of screen
00305 LD HL,PMSG ;file name error msg
00306 CALL VDLNLS
00307 CALL TAPENT ;Tap enter to continue
00308 JP GETFIL ;loop back and get file spec's
00309
00310 ;FNOK
00311
00312 ;file name syntax OK
00313 ;HL->source file name
00314 ;DE->index file name
00315 LD HL,INDCB ;space compress source file spec
00316 CALL PACKFS ;and move to source file DCB
00317 LD HL,INAR ;HL->index file name
00318 CALL DE,MAPDCB ;space compress index file spec
00319 CALL PACKFS ;and move to index file DCB
00320 LD HL,ONAR ;HL->output file spec
00321 CALL DE,OPNAME ;DE->output file DCB
00322 CALL PACKFS ;space compress output file spec
00323 ;and move to index file DCB
00324
00325 ;OPMAP
00326
00327 ;open MAP index file
00328 LD BC,3*256
00329 CALL POSCUR ;13:cl
00330 CALL ERASEL ;erase to end of screen
00331 LD HL,INDEXFIL ;'Index File'
00332 CALL VOLINE
00333 LD HL,MAPDCB ;j/p to index file spec
00334 CALL VDLNLS ;dsp MAP file name
00335 LD HL,MAPDCB ;HL->index file record buffer (11rb)
00336 CALL DE,MAPDCB ;j/p to MAPDCB if read OK
00337 CALL OPEN ;open index file
00338 JP 1,OPMAP6 ;j/p OPMPAP6 if file open OK
00339 LD HL,MAPDCB ;leave TRSDOS error code
00340 CALL VDLNLS ;MAP open error message
00341 LD A,0
00342 CALL ERASDP ;restore TRSDOS error code
00343 LD B,PENULN ;dsp error msg
00344 LD C,$
00345 CALL POSCUR ;1st col, next to last row
00346 CALL TAPENT ;Tap enter to continue
00347 JP GETFIL ;loop back and get file spec
00348 ;j/p MAPLIR to true last record
00349 ;in index file
00350
00351 ;OPSRC
00352
00353 ;open source file
00354
00355 LD HL,MAPDCB ;first get header to determine which
00356 CALL DE,INDEXFIL ;file to open
00357 LD HL,MAPDCB ;header (sector # of index file)
00358 CALL DE,INDEXFIL ;DE->index file DCB
00359 CALL ERASEL ;read header
00360 LD HL,OPSRC3 ;j/p to OPSRC3 if read OK
00361 CALL ERASDP ;display error msg
00362
00363 LD B,PENULN
00364 LD C,$
00365 CALL POSCUR ;next to last line, first col
00366 CALL TAPENT ;Tap enter to continue
00367 JP GETFIL ;loop back and get file spec
00368
00369 ;OPSRC3
00370
00371 ;check for valid header
00372 ;MAPLIR has name of source file
00373 LD HL,MAPDCB
00374 CALL DE,INDEXFIL
00375 LD BC,9 ;'MINDEX 1.2'
00376 ;no. of bytes in CODE to be compared to
00377 ;title of header
00378 ;only 'MINDEX 1.' is checked
00379 ;get char from CODE
00380 CP (HL) and inc HL ;error in header if not equal
00381 JP NZ,ERRR ;j/p to next char in header
00382 LD HL,INDEXFIL ;loop until char in BC checked
00383 CALL ERASDP ;'MINDEX 1.' present in header
00384 ;header error msg
00385
00386 LD HL,INDEXFIL
00387 CALL TAPENT ;Tap enter to continue
00388 LD HL,INDEXFIL
00389 CALL GETFIL ;j/p back to beginning and start again
00390 ;header ok
00391 LD HL ;HL-> byte 10 in header
00392 LD HL ;HL-> byte 11 in header
00393 LD HL ;header byte 11 contains indexing format
00394 ;codes: ' ' = paragraph format
00395 ; '000' = record format
00396 ; get indexing format code
00397 ; leave
00398 LD A,(HL)
00399 LD B,A
00400 CP ' '
00401 CALL R,PARFOR ;set prog for paragraph format
00402 CP '0'
00403 CALL R,RECFOR ;set prog for record format
00404 ; display 'record format' msg
00405
00406 ;header format OK
00407 ;get source file spec
00408 ;HL-> byte # of header
00409 LD HL,MAPDCB

```

CHILD'S PLAY

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This machine language program contains fast animation, sound effects, tunes, and speech. The speech has two options: it can be generated by computer or by a VS100 speech synthesizer (speech options described later). The program is easily controlled by a friendly menu-man who points to the options that may be chosen. The main menu contains four sections: •Learn the Alphabet •Learn to count •Learn Shapes • Learn Words. Each section contains three subsections which can easily be manipulated, giving twelve games in all. The menu selection is accompanied by a different nursery rhyme tune for each menu.

LETTERS

This option allows the child to select letters at random, match the current letter displayed or type in the next letter. When a correct response is given, an animation associated with the letter moves across the screen, e.g., Z or Zebra. The computer says the letters also.

NUMBERS

This option allows the child to select the numbers zero to nine at random, match the current number displayed, or type in the next number. Men walk out on the screen equal to the number chosen. This section also contains speech.

SHAPES

This section allows the child to control the menu-man, moving shapes from the left hand of the screen to the right hand of the screen. The first level allows the child to pick up shapes using the spacebar. The second level, in addition allows the child to control the menu-man with the arrow keys. The third level puts a small 'Bee' on the screen which the child must avoid while manipulating the menu-man and shapes.

WORDS

This final section allows the child to type in letters to form words. The first level asks for a word to be typed in, then to be repeated

before another word can be tried. The second level prompts the child with a word which must be matched before an animation will appear on the screen. The last level shows the animation on the screen. Then the child must type in the correct word before the next animation is shown. This section contains speech also.

SPEECH

The program can be bought as a stand-alone program with computer-generated speech, which uses 'your' speaker amplifier. However, we have also made the program compatible with an 'Alpha Products VS100' speech synthesizer for improved speech quality. (This can be purchased from 'Alpha Products' subject to availability). The speech is not available for a 16K machine. Software available for the TRS80* Models 1, III, and IV. Also soon available for the Timex. 18K tape (no speech). 32K tape. 32K disk. 48K disk. All programs for:

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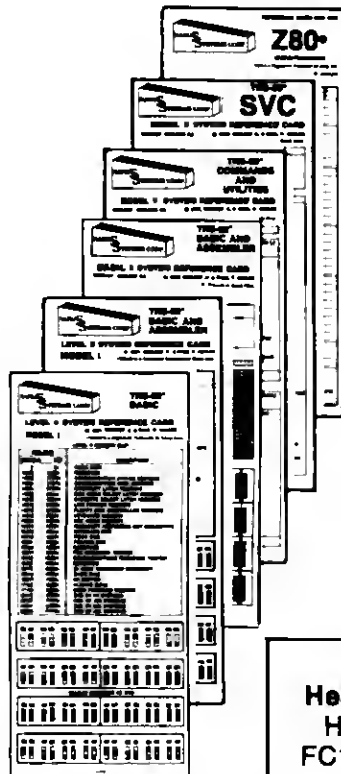
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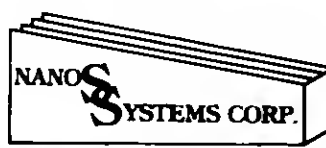
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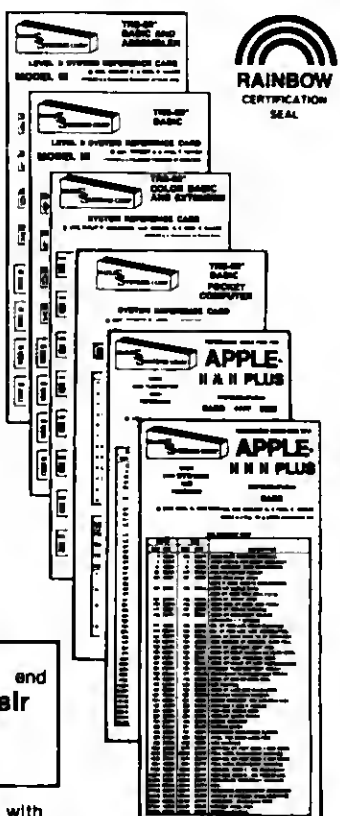
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```

00311 LD DE,20 ;offset 20
00312 ADD HL,DE ;HL->start of file spec
00313 LD DE,IMDCB ;DE->source file DCB
00314 CALL APPEND ;
00315 ;
00316 ;
00317 ; if source file drive specified by
00318 ; user append to current file spec
00319 ; HL->source file drive spec
00320 CP #DH ;
00321 JR 1,OPSRK5 ;if no source file dr specified
00322 ;source file drive specified so add
00323 ;" " and drive no.
00324 ;remember DE->end of src file spec in DCB
00325 LD A," "
00326 LD (DE),A ;add colon to file spec
00327 DE ;bump DE
00328 LD A,#DH
00329 LD (DE),A ;add ROR to file spec
00330 LD HL,SODR ;point to source file drive spec
00331 CALL APPEND ;move src file drive spec to DCB
00332 DPSRCS ;"Source file"
00333 CALL VDLINE ;
00334 ;source file spec in IMDCB
00335 LD HL,IMDCB ;display source file spec
00336 CALL VDLINB
00337 ;
00338 ;move source file name to CPFILE buffer
00339 ;CPFILE used to display file name during
00340 ;operation of program
00341 LD HL,IMDCB ;HL->to source file spec
00342 LD DE,CPFILE ;DE->CPFILE (current file)
00343 LD C,# ;set counter to 8
00344 CPSR5L ;
00345 LD A,C ;
00346 ;were eight char moved to CPFILE
00347 JP to OPSR6 if 8 char in source file name
00348 ;get char from file spec
00349 CP '/'
00350 JR 1,OPSR6 ;if ext
00351 CP ' '
00352 JR 1,OPSR6 ;if drive
00353 CP ' '
00354 JR 1,OPSR6 ;if password
00355 LD (DE),A ;copy file name char to CPFILE
00356 INC HL ;pt to next char in file spec
00357 INC DE ;pt to next char in CPFILE
00358 C ;inc counter
00359 CPSR5L ;loop until entire file name transferred
00360 LD A,3
00361 LD (DE),A ;
00362 ;put B3 at end of file name
00363 ;B3 indicates end of record
00364 ;When current file name is displayed
00365 ;VDLINE will not position cursor to next line
00366 ;
00367 ;
00368 LD HL,IMDPR ;HL->source file record buffer (srch)
00369 LD DE,IMDCB ;DE->source file DCB
00370 LD B,# ;record len = 8
00371 CALL OPEN ;open source file
00372 JZ OPSR6 ;if not error
00373 PUSH AF ;save error code
00374 LD HL,DATABR ;"Error in data/text file" msg
00375 CALL VDLINE ;
00376 LD HL, ;restore error code
00377 POP AF ;
00378 LD B,PCNULN ;dnp error msg
00379 LD C,# ;
00380 CALL POSCUR ;
00381 CALL TAPENT ;reset to last line, 1st col
00382 JP GETFILE ;tapent to continue
00383 ;loop back and get file spec
00384 ;
00385 LD A,B ;
00386 LD (DCBRL),A ;set LRL(record length) = 255
00387 CALL SETLIL ;set INLIL to true last record
00388 CALL LDMAP ;load as much of the index file
00389 ;into memory as possible
00390 CALL VDCILS ;clear screen
00391 RET ;
00392 ;-----
00393 ;LDMAP ;LDMAP
00394 ;-----
00395 LD HL,LDM3SG ;loada map sectors into memory
00396 CALL VDLINB ;
00397 LD HL,(WREND) ;memory end
00398 LD DE,512 ;safety buffer: 512 bytes
00399 KOR A ;
00400 SBC HL,DE ;
00401 LD HL,(LSTSEC),HL ;no more storage beyond
00402 HL,STWAP ;HL,STWAP
00403 LD HL,(NEXTMAP),HL ;NEXTMAP -> first map byte
00404 BC,B ;
00405 LDMAPL NOP ;
00406 LD C ;
00407 LD DE,MAPDCB ;
00408 CALL READER ;
00409 JA 1,LDMAP3 ;
00410 CP 20 ;
00411 JP NZ,ERROR ;
00412 NOP ;LDMAP3
00413 LD HL,MAPFUP ;
00414 LD DR,(NEXTMAP) ;
00415 LD BC,256 ;
00416 LDJ POP BC ;
00417 ;
00418 LD HL,(NEXTMAP),DE ;
00419 LD HL,(LSTSEC) ;
00420 A ;
00421 SBC HL,DE ;
00422 LD C,BOROOM ;
00423 JP LDMAPL ;
00424 DEC BC ;no more seen for MAP
00425 PUSH BC ;
00426 LD HL,LIMIT ;
00427 CALL VDLINB ;
00428 POP HL ;
00429 CALL BXDBC ;
00430 CALL VDLINB ;
00431 LD HL,LIMIT1 ;
00432 CALL VDLINB ;
00433 LD HL,(KDCBCR) ;
00434 CALL BXDBC ;
00435 CALL VDLINB ;
00436 LD HL,LIMIT2 ;
00437 CALL VDLINB ;
00438 CALL TAPENT ;
00439 NOP ;LDMAP2
00440 LD HL,(NEXTMAP) ;end of map storage
00441 LD HL,(NEXTMAP),HL ;
00442 LD HL,MAPRND ;
00443 CALL VDLINB ;
00444 RET ;
00445 ;-----
00446 LOINS3 DEFN 'Loading MAP Index'
00447 DEFN #DH
00448 LIMIT DEFN 'Memory not sufficient to hold entire MAP Index'
00449 DEFN #DH
00450 LIMIT1 DEFN ' '
00451 DEFN #DH
00452 LIMIT2 DEFN ' MAP Index sectors contained in memory'
00453 DEFN #DH
00454 ;-----
00455 ;MBRFLP ;
00456 ;-----
00457 ;main-help screen
00458 ;c61cl
00459 MBRFLP LD BC,5*256
00460 CALL POSCUR
00461 CALL ERASES
00462 LD HL,IMSG2
00463 CALL VDLINB

```

```

#0463      LD      A,BDR
#0464      CALL    VDCBAR           ;skip line
#0465      LD      HL,RMSG4
#0466      CALL    VDLINB
#0467      LD      HL,RMSG6
#0468      CALL    VDLINL
#0469      LD      HL,RMSG8
#0470      CALL    VDLINR
#0471      LD      B,FENDLEN
#0472      LD      C,S
#0473      CALL    PQSCUR
#0474      CALL    TAPERT
#0475      JP      GETP_IL1
#0476      RMSG2    DEFN      'Format: SOURCE FILE,INDEX FILE,OUTPUT FILE'
#0477      DEFB      0DH
#0478      RMSG4      DEFN      'Only the source file specification is required'
#0479      DEFB      0DH
#0480      RMSG6      DEFN      'The index file will have the same name, but extension "MAP"'
#0481      DEFB      0DH
#0482      RMSG8      DEFN      'The output file may be specified from within the program'
#0483      DEFB      0DH
#0484      )-----
#0485      MSG2      DEFN      'Enter file name, or ? for help'
#0486      DEFB      3
#0487      MSGPF      DEFN      'Paragraph Format'
#0488      DEFB      0DH
#0489      MSGR7      DEFN      'Record Format'
#0490      DEFB      0DH
#0491      MSGOP      DEFN      'FILES OPENED'
#0492      DEFB      0DH
#0493      NACPMD      DEFN      'MAP'
#0494      DEFB      0DH
#0495      HEADNR      DEFN      'Error in MAP Index File Header'
#0496      DEFB      0DH
#0497      NAPOER      DEFN      'Error in Attempt to Open MAP Index File'
#0498      DEFB      0DH
#0499      DATAER      DEFN      'Error in Attempt to Open Data/Test File '
#0500      DEFB      0DH
#0501      IDXFIL      DEFN      'Index File: '
#0502      DEFB      03
#0503      SRCFIL      DEFN      'Data/Test File: '
#0504      DEFB      03
#0505      MSGNAM      DEFN      'File Name: '
#0506      DEFB      3
#0507      FMSGND      DEFN      'Error in file name format'
#0508      DEFB      0DH
#0509      MAPRD      DEFN      'MAP READ COMPLETE'
#0510      DEFB      0DH
#0511      )-----
#0512      END

```

```

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00002 ,Jan 21, 1983
00003 -----
00004 SEARCH DISPLAY ROUTINE (DISPLAY RECORD OR LIST FILE)
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00006 -----
00007 SDBF PSECT ;begin relocatable program section
00008 -----
00009 ;public routines
00010 -----
00011 PUBLIC BYUPDN ;bypass updown control buffer
00012 PUBLIC LIST ;list file routine
00013 PUBLIC DSP ;display record routine
00014 -----
00015 ;calls to MODII or MODI11
00016 -----
00017 EXTERN KBLINE,KBLIN3,KCHAR,KWAIT,KZIN,KZINIT
00018 EXTERN KERR
00019 EXTERN VDCLE,VOLINE,VCHAR,VDMIT
00020 EXTERN HOME,BOTTOM,NEWLN
00021 EXTERN CURPOS,POSCUR
00022 EXTERN SCRPOS
00023 EXTERN GRASL,ERASES
00024 EXTERN OUTCR
00025 EXTERN PAINIT,PARCH,PRTBLN,PTRBC
00026 EXTERN PALINE,NOVELN,PRTUP
00027 EXTERN POSCOF,POSN,SEADR,WRITX,ARCSEP
00028 -----
00029 ;MODII/11 buffers and I/O parameters
00030 -----
00031 EXTERN INDCB,INCBRL,INDCBR,INCBRL,INLRL,INCBOS
00032 EXTERN MAPDCB,KDCBRL,KDCBR,KDCBLA,NPRLA,KDCBOS
00033 EXTERN OUTDCB
00034 EXTERN ERDCSP
00035 EXTERN SORLH,STREND,REMRD
00036 EXTERN ARROW,ARROWI,ARROWU,ARROWD,SRKEY,SWIDTH,PENULH
00037 -----
00038 ;s3 buffers
00039 -----
00040 EXTERN INBUF,INBUPE,INBUPI,NINSET,NINSET
00041 EXTERN LINWR,SMWORD,EOF,MGEOF,SEARSG
00042 EXTERN CWDG,SMODE,PRMODE,MODE,RECBUF
00043 EXTERN NITREC
00044 -----
00045 ;calls to S3 routines
00046 -----
00047 EXTERN READIS,OPWOUT,OUTARC
00048 -----
00049 ;calls to GR (general routines)
00050 -----
00051 EXTERN SDEC,DECB,DEPNB
00052 EXTERN DLIN
00053 -----
00054 ;LIST
00055 -----
00056 ;list file from start of current rec
00057 ;entry: current record is ARCBUF
00058 ; current sector is INBUF
00059 ; IX -> current arc sector
00060 ;exit:
00061 ;mg altered: AF,BC,DE,HL
00062 ;calls: LIST1
00063 LIST LD A,'N'
00064 LD (BYUPDN),A ;N = do not bypass updown routine
00065 CALL DLIN ;display dotted line under last search record
00066 LD A,'I'
00067 LD (MODE),A ;list mode
00068 PUSH IX ;save
00069 PUSH IX ;save
00070 PUSH IX
00071 POP BC ;BC -> current arc sector
00072 LD HL,(NOTREC)
00073 CALL LIST1
00074 POP IX
00075 POP IX
00076 RET
00077 -----
00078 ;LIST#
00079 -----
00080 ;entry pts: LIST1
00081 ;arc file input buffer
00082 LIST# LD HL,INBUF
00083 JR LIST2
00084 PUSH HL ;save HL (-> INBUF)
00085 LD HL,LIST#1 ;'Listing'#3
00086 CALL VOLINE
00087 CALL NEWLN
00088 POP HL ;pos to next to last line
00089 LD A,(NINSET) ;HL -> INBUF
00090 LD (NINSET),A ;get current inset value
00091 LD A,#1 ;save current inset value
00092 LD (NINSET),A ;set inset to #
00093 LIST2 LD A,1
00094 LD (LINNR),A ;set line no. = 1
00095 LD B,SWIDTH ;B = screen width
00096 -----

```

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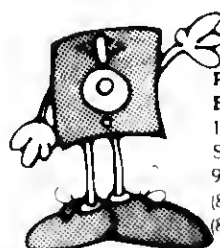
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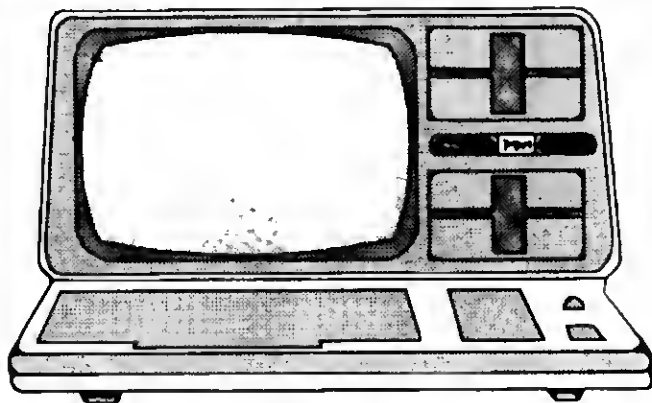
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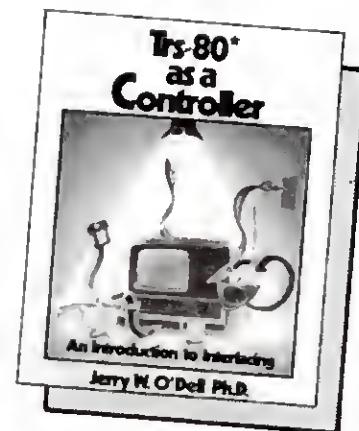
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Listing 11 continued

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00097 ;LIST3
00098 ;-----
00099 LIST3 CALL NXTWRD ;process next word
00100 LD A,' ' ;get next word
00101 LD (SPWORD),A ;working with word
00102 PUSH HL ;save HL
00103 LD HL,INBUFW ;EDM byte after INBUFW
00104 A FOR
00105 SBC HL,DE
00106 POP HL ;restore HL
00107 JP 1,LIST4 ;get next nec
00108 LD A,8
00109 CP C
00110 JR 1,LIST3C
00111 CALL DSPWDN ;display word
00112 CP BRKKEY ;break?
00113 JP 1,LIST7 ;if LIST7 if break
00114 CP 'a' ;was 'a' pressed
00115 JP 1,LIST7 ;yes, then search
00116 CP ARROW ;was arrow pressed? (backspace)
00117 JP 1,LIST7 ;yes, then search
00118 LD A,(HL)
00119 CP 0
00120 JP 1,LIST5 ;get next space or set of spaces
00121 LIST3C CALL SPACE
00122 LD A,' '
00123 LD (SPWORD),A ;space=word = (space)
00124 PUSH HL
00125 LD HL,INBUFW
00126 A FOR
00127 SBC HL,DE
00128 POP HL
00129 JP 1,LIST4
00130 CALL DSPSP ;used for listing only
00131 CP BRKKEY ;break?
00132 JP 1,LIST7 ;exit and get new search key
00133 CP 'a' ;is pressed?
00134 JP 1,LIST7 ;exit and resume search
00135 CP ARROW ;up arrow?
00136 JP 1,LIST7 ;backsp, no start listing again
00137 LIST4 LD A,(HL)
00138 CP 0
00139 JP NE,LIST3 ;loop until EOM encountered
00140 ;-----
00141 ;LIST5
00142 LD DE,INBUFW
00143 LD HL,A
00144 SBC HL,DE
00145 POP HL
00146 JP 1,LIST2 ;if HL at end of buffer
00147 CALL UPDOWN ;break?
00148 JP 1,LIST7 ;exit and get next search key
00149 CP ARROW ;up arrow
00150 JP 1,LIST7 ;backsp, no start listing again
00151 CP 'a' ;is pressed?
00152 JP 1,LIST7 ;exit and continue search
00153 LD A,SWIDTH ;screen width
00154 CP B ;new line?
00155 JP 1,LIST4 ;roll screen in new line needed
00156 LIST5 LMC HL,SWIDTH ;reset count for char printed on line
00157 LD HL,LIST3 ;HL->next char after ED
00158 CALL LIST3 ;loop until EOM
00159 LD A,' ' ;roll screen
00160 JP LIST7
00161 ;-----
00162 ;LIST7
00163 ;EDM at INBUFW (record extends past
00164 ;INBUFW buffer)
00165 LIST7 CALL UPDOWN
00166 CP BRKKEY ;break?
00167 JP 1,LIST7 ;exit and get new search key
00168 CP ARROW ;up arrow?
00169 JP 1,LIST7 ;backsp, no start list again
00170 CP 'a' ;is pressed?
00171 JP 1,LIST7 ;exit and search end?
00172 LD A,SWIDTH
00173 CP B ;new line?
00174 JP 1,LIST23 ;roll screen
00175 LIST23 LD C,0
00176 LD A,' '
00177 LD (SPWORD),A
00178 LD DE,INBUFW
00179 JP LIST4
00180 ;-----
00181 ;LIST4
00182 ;word of spaces cross sec
00183 ;shift word/4 to INBUFW
00184 LIST4 LD A,(EOP)
00185 CP 1
00186 JP 1,LIST5 ;has EOP been reached?
00187 LD HL,INBUFW ;if LIST5 if EOP
00188 LD DE,INBUFW ;transfer remainder of INBUFW to SINBUFW
00189 DEC DE
00190 PUSH BC
00191 LD A,0
00192 LD A,C
00193 CP B
00194 JP NE,LIST43 ;if 8 then no trans
00195 BC ;restore stack
00196 JP LIST4
00197 LIST41 INC BC ;include char before string to be transferred
00198 LD HL ;trans to SINBUFW
00199 INC DE ;adjust for inc of BC
00200 INC DE ;adjust for inc of BC
00201 INC DE ;DR->1st char of word
00202 PUSH DE
00203 LD HL
00204 LD A,(SPWORD)
00205 CP 'a'
00206 JP 1,LIST3C
00207 JP LIST3
00208 LIST48 NOP ;no word/sp in SINBUFW
00209 LD HL,INBUFW ;start word at INBUFW
00210 PUSH BC
00211 PUSH DE
00212 LD HL
00213 LD A,(SPWORD)
00214 CP 'a'
00215 JP 1,LIST3C
00216 JP LIST3
00217 LIST45 LD A,(EOP)
00218 CP 1
00219 JP 1,LIST5 ;has EOP been reached?
00220 PUSH BC ;if LIST5 if EOP
00221 LD DE,INBUFW
00222 LD DE,INBUFW
00223 LD BC,(IDBCR) ;get current record
00224 INC BC ;now points to next record
00225 CALL READIN ;read next record
00226 POP DE
00227 POP BC
00228 LIST42 LD HL->INBUFW-C
00229 POP DE ;DE-> word start in SINBUFW
00230 LD HL ;HL-> word start in SINBUFW
00231 LD DE,INBUFW
00232 LD A,(SPWORD)
00233 CP 'a'
00234 JP 1,LIST3C
00235 JP LIST3
00236 LIST48 NOP ;no word/sp in SINBUFW
00237 LD HL,INBUFW ;start word at INBUFW
00238 PUSH BC
00239 PUSH DE
00240 LD HL
00241 LD A,(SPWORD)
00242 CP 'a'
00243 JP 1,LIST3C
00244 JP LIST3
00245 LIST58 NOP ;EOP reached
00246 LD HL,INBUFW
00247 POP BC

```

```

00248 CALL NEWLN
00249 LD HL,MSGEOP
00250 CALL VDLINR
00251 CALL ESWAIT
00252 CP BRKKEY ;break?
00253 JP 1,LIST7
00254 DE 32
00255 CP 'a'
00256 JP NE,LIST52
00257 JP LIST7
00258 ;-----
00259 ;LIST7
00260 ;exit from LIST routine
00261 ;save A status
00262 LIST7 PUSH AF
00263 LD A,(RIMSET)
00264 LD (RIMSET),A ;restore inset
00265 LD A,8
00266 LD (EOP),A ;restore to not EOP
00267 POP AF ;restore A
00268 CP 'a'
00269 REV R1 ;return if break
00270 CALL SEARSK ;Searching?
00271 LD A,'a' ;return and continue searching
00272 RET
00273 ;-----
00274 LISTM1 DEFN 'Listing '
00275 DEFS 1
00276 ;-----
00277 ;DSP
00278 ;display record found while searching
00279 ;record is in RECURF
00280 ;is used for count of char remaining
00281 ; on current line
00282 ;entry:
00283 ;exit: A = end from UPDOWN routine
00284 ;reg altered: AF,BC,DE,HL
00285 ;call: NXTWRD,DSPWDN,SPACE,DSPSP
00286 DSP LD A,(MODE)
00287 CP 'C'
00288 CALL 1,OUTBRC ;is output mode continuous?
00289 LD A,NEWLN ;if so, output record
00290 INC A
00291 LD (EOP),A ;since EDMLN dec's EDMLN as soon as
00292 LD A,(EOP) ;record is displayed
00293 LD A,(EOP) ;start of record on panititine line
00294 CP 'a' ;record?
00295 JP 1,DSPRC ;display entire record
00296 CP 'C' ;continuous display?
00297 JP 1,DSPRC ;display entire record
00298 ;-----
00299 ;DSPLN
00300 LD A,' '
00301 LD (EOP),A ;do (N)ot bypass UPDOWN routine
00302 LD A,1
00303 ;-----
00304 ;DSPRC
00305 LD A,' '
00306 LD (EOP),A ;do (Y)es bypass UPDOWN routine
00307 LD A,1
00308 ;-----
00309 ;DSP1
00310 LD A,'a'
00311 LD (MODE),A ;search mode
00312 LD A,1
00313 LD (EOP),A ;string ends with EOP
00314 LD A,1
00315 LD (EOP),A ;1 = first line
00316 LD A,2
00317 LD (EOP),A ;2 = 2..n lines
00318 JP DSP4 ;checks for null record
00319 CALL NXTWRD ;get next word
00320 CALL DSPWDN ;display word
00321 CP BRKKEY ;break?
00322 JP 1,DSP6 ;exit if break
00323 CP 'a' ;switch to list mode?
00324 JP 1,DSP8 ;exit if switch in mode
00325 CP 'C' ;was last char at EOP?
00326 LD A,(HL) ;pt to next char in record
00327 LD A,0
00328 LD A,0
00329 LD A,0
00330 LD A,0
00331 LD A,0
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00397 LD A,0

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Listing 11 continued

Listing 11 continued

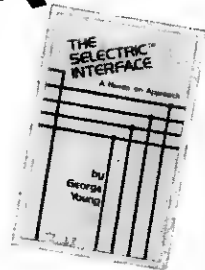
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00398      NRTWRD  PUSH    HL          ;reg altered: AP,C,DE
00399      LD      C,0              ;save start of word
00400      NWRDLF  LD      A,(HL)
00401      CP      0DH              ;EOR?
00402      JP      Z,NWRDRT          ;EOR encountered
00403      CF      2,NWRDRT          ;' '?
00404      LD      A,SWIDTH          ;space encountered
00405      CP      C
00406      JP      M,NWRD65          ;don't inc C after SWIDTH
00407      INC      C              ;bump char counter
00408      NWRD65  CALL    NL          ;bump NL
00409      JP      NWRDLF          ;loop until end of word
00410      LD      D,S              ;D8-> char after word
00411      LD      E,L              ;HL->start of word
00412      POP      HL
00413      RET
00414      -----
00415      ;DSPWRD
00416      DSPWRD  NOF
00417      ;display word
00418      ;entry: HL-> start of word
00419      ; C = word length
00420      ; B = # spaces left on line
00421      ;exit: B = # spaces left on line
00422      ;exit ptr: DWRD2,DWRD7,DWRD11,DWRD12
00423      ;reg altered: AF,BC,DE,HL
00424      DWRD2  LD      A,B
00425      CP      C
00426      RET      Z              ;return if null word
00427      LD      A,B
00428      CP      C
00429      JP      Z,DWRD4          ;is there room for word?
00430      JP      P,DWRD4
00431      PUSH    DE
00432      CALL    UPDOWN          ;? down arrow
00433      CP      NS,DWRD10        ;jp if not d. arrow
00434      CALL    NEWLN          ;DE
00435      CALL    INSET          ;inset
00436      LD      A,(HL)
00437      AND      7FH              ;point to char
00438      CALL    VDCCHAR          ;mask bit 7
00439      DEC      B              ;display char
00440      LD      A,B
00441      CP      0
00442      JP      NZ,DWRD7          ;one less space
00443      INC      HL
00444      INC      HL
00445      JP      Z,DWRD12          ;no inset if EOR
00446      DEC      HL
00447      CALL    UPDOWN          ;down arrow?
00448      CP      NZ,DWRD11        ;jp DWRD11 if not down arrow
00449      CALL    NEWLN          ;inset and adjust B (# char remaining on line)
00450      CALL    INSET          ;inset char pointer
00451      LD      A,(HL)
00452      CP      0
00453      JP      Z,DWRD5          ;get next char
00454      RET      Z
00455      RET      Z
00456      RET      Z
00457      RET      Z
00458      RET      Z
00459      RET      Z
00460      RET      Z
00461      RET      Z
00462      RET      Z
00463      RET      Z
00464      RET      Z
00465      RET      Z
00466      RET      Z
00467      RET      Z
00468      RET      Z
00469      RET      Z
00470      RET      Z
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00472      RET      Z
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00503      RET      Z
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00505      RET      Z
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00520      RET      Z
00521      RET      Z
00522      RET      Z
00523      RET      Z
00524      RET      Z
00525      RET      Z
00526      RET      Z
00527      RET      Z
00528      RET      Z
00529      RET      Z
00530      RET      Z
00531      RET      Z
00532      RET      Z
00533      RET      Z
00534      RET      Z
00535      RET      Z
00536      RET      Z
00537      RET      Z
00538      RET      Z
00539      RET      Z
00540      RET      Z
00541      RET      Z
00542      RET      Z
00543      RET      Z
00544      RET      Z
00545      RET      Z
00546      RET      Z
00547      RET      Z

```

Listing 11 continued

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Listing 11 continued

```

00540 JP      RT,DPMSPP      ;rp if not d arrow
00541 CALL  RSTCLR
00542 CALL  INSET
00543 JP      DPSPPC
00544 DPSPPC PUS  DE
00545 PUS  DE
00546 LD   B,A
00547 CP   B
00548 JP   Z,DPSPPC
00549 CALL  WDELH
00550 POP  DE
00551 POP  AF
00552 POP  BL      ;HL->don't word
00553
00554
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```

00636 JP      1,UPDOWNP      ;do not exit if already in list mode
00637 LD   A,'1'
00638 LD   (MODE),A
00639
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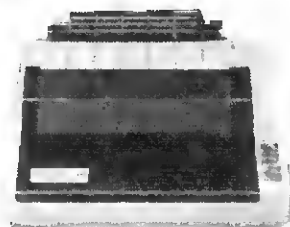
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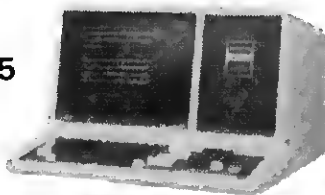
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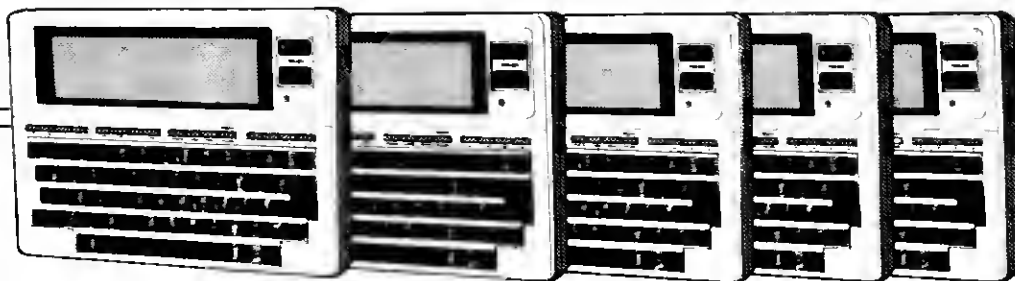
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Inside the Model 100

by David P. Sumner

To help you write sophisticated programs on your Model 100, I'm providing a fairly extensive memory map, some relevant documentation, and a list of the tokens for the Basic keywords.

One word of caution: It's possible that some versions of the Model 100 have a ROM slightly different from the one in my machine. You should also be aware that some locations have multiple uses, some of which may not be documented here.

Running a Machine-Language Program

You will find the addresses of several routines provided in the memory map useful (see Table 1) primarily for machine-language programs, but it's important to know how to access them from Basic. The secret is in the Basic command Call. To run a machine-language program that resides at location 30306 (the Model 100's sound routine), type in the Basic statement CALL 30306 and you'll hear a beep. Not all Calls are so direct. Often you'll need to pass data to the routine that you're calling. The Model 100 provides nicely for this. A statement of the form

CALL address,X,Y

initiates the execution of the machine code stored at the given address, but first it assigns the value in X to the accumulator, and the value in Y to the register pair HL. Thus, the value of X can only be between zero and 255 (so that it can fit into the 8-bit accumulator), and the value of Y can be any 16-bit integer from zero to 65535.

For example, a Call to location 32 prints the contents of the accumulator (considered an ASCII character) on the display. If you simply type CALL 32, nothing happens since the accumulator contains zero. However, if you type CALL 32,65 you'll see the letter A appear on the screen. You've put 65, the ASCII code for an A, into the accumulator prior to the Call. The effect of CALL 32,X is the same as printing CHR\$(X). In fact, since PRINT CHR\$(7) produces a beep, CALL 32,7 also results in a beep. Another example: The routine located at 10161 displays the message located at the address pointed to by the register pair HL. If you look at the memory map, you'll see that the 100 stores many messages throughout the ROM. For example, try typing CALL 10161,0,3442. The computer displays the message "extra ignored." Type CALL

The Key Box

The programs in "Blackjack" and "Program Length" will run in 8K RAM.

Table 1. The memory map.

NOTE: Material in single quotes represents ASCII text. A "+" after a location indicates a 2-byte pointer.

0	(RST 0) JMP 32051
3	'Menu'
8	(RST 1) Test for special character and fall into RST2.
16	(RST2) Set pointer to next character of BASIC text. (JMP 2136)
24	(RST3) Compare registers HL,DE directly
32	(RST 4) PRINT ASCII contents of accumulator.
36	(TRAP) Handles power-down. User interface at 62978.
40	(RST 5) JMP 4201 Checks variable type.
44	(RST 5.5) JMP 62969
48	(RST 6) Returns sign of FAC1. (JMP 13276)
52	(RST 6.5) JMP 20076 (62972 RAM vector interface)
56	(RST 7) Executes routine indicated by next byte. (JMP 32767)
60	(RST 7.5) Updates timer, adjusts power-down values etc. (JMP 6962, user can interface at 62975).
64	BASIC function addresses.
128	BASIC Keywords with high bit set in the first character of each word.
610	BASIC command addresses.
750	Table of BASIC addresses.
796	2-Byte error codes.
858	Initial values for pointers 62960-63103.
1003	'Error'
1010	'in'
1014	'ok'
1019	'Break'
1094	Syntax error. Other entry points at 1100, 1103 .. 1115 for other errors.
1117	Error message based on contents of E register.
1245	PRINTs error messages (accumulator holds a value from 20 to 58).
1520	Builds BASIC line pointers.
1576	Enter with DE containing a line number. Exit with BC containing

Table 1 continued

10161,0,32676, and the TRS-80 logo will appear on the display.

PEEK, POKE, and Pointers

There is more of interest here than just the addresses of particular routines. Basic uses many locations to store data such as the values of variables, the text of Basic programs, and pointers that determine how the computer behaves. The PEEK command accesses the values in these locations, and the POKE command can change them.

For instance, the location 63368 contains the horizontal position of the cursor. If you let $X = \text{PEEK}(63368)$ in a Basic program, the effect is the same as if you had used the expression $X = \text{POS}(0)$. Try the following short program as an illustration. (Don't overlook the semicolon in line 20.)

```
10 FOR I = 1 TO 100
20 PRINT PEEK(63368);
30 NEXT I
40 END
```

If the number stored in location 64173 is zero, then you cannot use the label line. With a POKE command you can put a zero into this location. Try the following experiment. First enter Basic from the main menu and then press the label key.

You'll see the key menu displayed on the label line. Now clear the label line by pressing the label key again. Finally, type POKE 64173,0 and press the enter key. Pressing the label key now has no effect. If you type

POKE 64173,255

things return to normal.

Many of the pointers point to addresses, line numbers, and other 16-bit integers. The Model 100 stores such addresses with the low byte of the integer followed by the high byte. For instance, the computer stores the line number where a break occurred in locations 64426-64427. To determine the line number just type $\text{PRINT PEEK}(64426) + 256 * \text{PEEK}(64427)$.

To determine the starting location of the currently active program, type $\text{PRINT PEEK}(63100) + 256 * \text{PEEK}(63101)$.

Floating Point Operations

In order to use the floating point routines, you must first place the proper values in the floating point accumulators. For instance, to find the square root of 2 using a call to location 12378, you must place 2 in the primary floating point accumulator FAC1 prior to the call. After the call, the value of the square root of 2 resides in FAC1, and you must move it to the proper variable.

Table 1 continued

	the location of the line, and HL the location of the next line. The carry flag is used to indicate if the line exists.		
1606	Tokenize BASIC text.	2902	PRINT
1830	FOR	3073	TAB(
1899	TO	3141	LINE (general)
2112	BASIC command dispatcher; accumulator holds token.	3152	LINE INPUT
2136	Set pointer to BASIC text.	3188	'?Redo from start'
2162	DEF (general)	3225	INPUT #
2177	DEFDBL	3235	INPUT
2182	DEFINT	3289	READ
2198	DEFSNG	3442	'Extra ignored'
2207	DEFSTR	3625	>,<
2267	FC error.	3926	ERL
2283	Used by GOTO, GOSUB, and RUN to determine the 2-byte value of the line (in ASCII) to branch to. The HL register points to the ASCII string of digits, the 16-bit integer is returned in DE.	3966	VARPTR
2319	RUN	4072	If character in M is lowercase, the upper case equivalent is returned in the accumulator.
2334	GOSUB	4236	OR
2358	GOTO (contains a bug!)	4247	AND
2381	Jump here if UL error.	4258	XOR
2406	RETURN	4269	EQV
2462	DATA	4277	IMP
2464	REM, ELSE	4296	LPOS
2499	LET	4302	POS
2607	ON (general)	4305	Store accumulator as low byte of 16-bit integer.
2612	ON ERROR	4352	INP
2736	RESUME	4364	OUT
2831	ERROR	4398	ASCII text (string/variable) converted to integer.
2842	IF	4411	LLIST
2894	LPRINT	4416	LIST
		4514	PRINTs from buffer until 0 byte is encountered.
		4522	Put data into buffer until a 0 byte is reached.
		4740	PEEK
		4747	POKE
		4811	Saves registers, waits for

Table 1 continued

Table 1 continued

	character of input, and restores registers.
4848	PASTE.
5029	Toggles the label line.
5138	Break routine.
5145	POWER
5169	Power off /Returns to program on power-up.
5201	Power off
5209	POWER CONT
5225	Sets power-down values.
5288	Preliminary tape I/O routine.
5290	Called at the end of tape I/O.
5296	Returns byte from tape in accumulator.
5313	Sends byte in accumulator to tape.
6281	EOP
6404	TIMES
6436	DATES
6485	DAYS
6520	ASCII of days stored here.
6553	Converts byte pointed to by DE to an ASCII digit. Result placed in M.
6571	TIMES (as command/assignment).
6589	DATES (as command/assignment).
6641	DAYS (as command/assignment).
6547	MAX RAM
6776	IPL
6814	COM,MDM
6851	KEY ON/OFF/STOP
6927	ON TIMES
7096	KEY (general)
7101	KEY LIST
7136	PRINTS B PRINTable-characters starting at address in HL.
7182	Defines function key. HL points to string, accumulator holds key number minus one.
7255	PSET
7270	PRESET
7277	Line drawing routine.
7519	Subroutine for PRINT @
7568	CSRLIN
7579	MAX (general).
7602	MAX FILES
7609	HIMEM
7619	WIDTH
7621	SOUND (general)
7653	SOUND OFF
7654	SOUND ON
7660	MOTOR
7667	Turns motor on.
7669	Turns motor off.
7674	CALL
7714	SCREEN
7774	LCOPY
7994	FILES
8081	KILL
8247	NAME
8446	NEW
8832	CSAVE (general)
8856	CSAVES current BASIC program.
8889	Sends the DE bytes starting at location in HL to tape.
8908	SAVEM
8925	CSAVEM
9079	CLOAD (general)

Table 1 continued

The routines that you need for these actions all appear in the map. You can use the machine code below to find the square root of the variable pointed to by the HL register pair.

```

PUSH H      ; We will need this address later.
CALL 12740  ; Put the variable into FAC1.
CALL 12378  ; Take the square root.
POP H       ; I told you we needed that address.
CALL 12746  ; Replace the value by its square root.
RET         ; That's all.

```

Access the program above from Basic by using the next program, being sure to protect it first by the command CLEAR 256,61999. This prevents Basic from destroying the machine code starting at location 62000.

```

5 GOSUB 100
10 INPUT "X ";X
20 A=VARPTR(X)+65536
30 CALL 62000,0,A
40 PRINT X
50 END
100 FOR I=0 TO 11
110 READ V
120 POKE 62000+I,V
130 NEXT I
140 RETURN
150 DATA 229,205,196,49,205,90,48,225,205,202,49,201

```

This program assumes that you've placed the machine-language routine at location 62000. Line 20 determines the memory location of the variable X, and line 30 passes this address to the register pair HL before executing the routine at 62000.

Lines 100-150 POKE the machine code described earlier into memory.

Now run the program, and you'll see that the value of the variable X is replaced by its square root.

Some of the other floating point functions seem to require the setting of the variable type flag prior to a Call.

Interrupts and the RST Instructions

Like the 8080, the Model 100's 8085 chip contains eight restart instructions that are effectively 1-byte Call instructions. (See Table 1.)

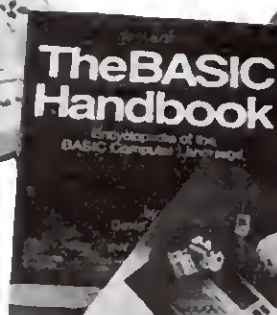
Unlike the 8080, the 8085 has several interrupt routines known by the mnemonics RST 5.5, RST 6.5, RST 7.5, and TRAP. The addresses of each of these resides in the low bytes of ROM. However, the Model 100 allows a user to intercept these routines by placing a Jump instruction in a particular location in RAM. These interface vectors are documented in the map.

The Basic Commands

The memory map contains the addresses of most of the Basic commands and functions. The important thing to realize is that most Basic commands expect the accumulator to contain the next byte of Basic text upon entry to the routine. Some commands, such as Beep and End, aren't modified by additional text. A simple call to the addresses of these routines has the desired effect. On the other hand, the actions of some commands depend upon the text that follows them. For example, consider the Key command. When this statement appears in a Basic program or in immediate mode, several things may

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follow it. For instance, KEY ON, KEY OFF, KEY LIST, or KEY 5, "PRINT" are all possible. At the time the program executes the command, the computer has already tokenized the keywords, and the Key routine expects to find the appropriate token or text in the accumulator. The token for ON is 151, and so typing CALL 7096,151 produces the effect of KEY ON. Similarly, since the token for LIST is 165, CALL 7096,165 will result in the same action as if you had entered KEY LIST. Unfortunately, you'll find that not all calls to Basic command locations respond as expected. So be cautious when experimenting with these addresses.

Using the Memory Map

The examples given earlier should help you take advantage of much of this information. You cannot use all of the routines in the ROM directly, however. Many of them, like the floating point operations, require setting up special conditions prior to the call. And, although I would strongly urge you to experiment with your computer, be sure you have saved any important data or programs on tape first. An inappropriate call or POKE can easily garble a program or cause the computer to hang. Of course, you will not damage the computer by such a crash, but you may be unable to restart the computer without using the memory kill button on the bottom of the computer.

About the Msp

Notice that items enclosed in single quotes represent actual ASCII text. For instance, the word 'Error' is stored in memory starting at location 1003. The letters H,L,D,E,B,C, and A refer to registers in the 8085. ■

David P. Sumner can be reached at 1009 Walters Lane, Columbia, SC 29209.

Table 1 continued

9235	Gets DE bytes from tape and stores them at the location pointed to by HL.
9302	CLOAD?
9345	'Verify failed'
9361	LOADM, RUNM
9383	CLOADM
9530	Moves B bytes from address in HL to address in DE in an increasing manner.
9587	CLOADM?
9685	'Top End Exe'
9697	'Exe:'
9982	'Found'
9989	'Skip'
10042	STR\$
10161	PRINTs message pointed to by HL. Message ends in quote or 0-byte
10444	String addition.
10500	Moves L bytes from address in BC to address in DE (increasing).
10563	LEN
10575	ASC
10597	CHR\$
10605	STRING\$
10630	SPACE\$

Table 1 continued

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10667 LEFT\$
 10716 RIGHT\$
 10726 MID\$
 10759 VAL
 10807 INSTR
 11084 FRE
 11113 FAC1 <-- FAC1-FAC2.
 11128 FAC1 <-- FAC1+FAC2.
 11519 FAC1 <-- FAC1*FAC2.
 11719 FAC1 <-- FAC1/FAC2.
 12006 Moves C bytes starting from address in HL to address in DE in a decreasing manner.
 12015 COS
 12041 SIN
 12120 TAN
 12145 ATN
 12239 LOG
 12378 SQR
 12452 EXP
 12606 RND
 12606 MOVE FAC1 to 64633-64640.
 12692 Adds memory to FAC1.
 12698 Subtracts memory from FAC1.
 12704 FAC1 <-- FAC1*FAC1 (squares FAC1)
 12707 Multiplies memory and FAC1.
 12725 Moves FAC1 to FAC2.
 12728 Moves number at address HL to FAC2.
 12737 Moves FAC2 to FAC1.
 12740 Moves number at address HL to

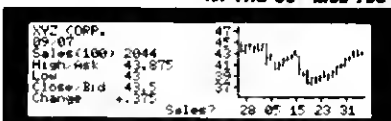
FAC1.
 12746 Moves FAC1 to address in HL.
 12852 Saves FAC1 on the stack.
 12892 Floating point constants.
 12942 .25
 12974 pi/2
 12990 Square root of 3.
 13015 1
 13203 2*pi.
 13298 ABS
 13309 Negate FAC1.
 13319 SGN
 13417 Moves B bytes of memory from address in DE to address in HL in an increasing manner.
 13426 Moves B bytes of memory from address in DE to address in HL in a decreasing manner.
 13569 CINT
 13610 CSNG
 13754 CDBL
 13893 FIX
 13908 INT
 14804 PRINTs the 16-bit integer stored in the register pair HL.
 16288 TIME\$ ON
 16306 TIME\$ OFF
 16313 TIME\$ STOP
 16393 Clears COM and TIME\$ locations. Clears KEY definitions and sets 63060 to 0

Table 1 continued

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Table 1 continued

15758		printer.
16511	RESTORE	19360 Sends carriage return to printer
16538	STOP	19434 INKEY\$
16543	END	19659 OPEN
16602	CONT	19824 LOAD
16625	Determines if RL points to an alphabetic character.	19825 MERGE
16626	Determines if the accumulator contains an alphabetic character.	19919 SAVE
16633	CLEAR	20000 CLOSE
16756	NEXT	20110 INPUT\$
16930	PRINT\$ CHR\$(13)+CHR\$(10)	20591 LFILES
16937	BEFP	20725 'CRT CAS COM WAND LPT MDM RAM'
16941	PRINT\$ CHR\$(11)	20806 TELCOM program.
16945	CLS	20558 Enter here or one of 20561,
17001	Turns on reverse video.	20563...20579 in case of file errors.
17006	Turns off reverse video.	20593 DSKO\$
17000	PRINT\$ CHR\$(27)+CHR\$ of accumulator.	20595 DSKI\$
17034	Clears the label line.	20860 'Telcom'
17064	PRINT\$ label line.	20869 'STAT'
17994	Puts input data into input buffer.	20874 'TERM CALL RFIND MENU'
18315	DIM	20900 'Find Call Stat Term Menu'
18320	Get variable name and type.	20906 'x pps'
18833	USING	21060 'Calling'
19268	PRINT\$ ASCII character in accumulator.	21890 'Full Half Echo'
19322	Sends byte in accumulator to the	21909 'Wait'
		22353 'File to upload File to download'
		22305 'aborted'
		22396 'No file'
		22406 'Disconnect'
		22417 PRINT\$ message. Sends a cr if not at start of a line.

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Table 1 continued

22423	MENU	27611	Moves BC bytes from address in HL to address in DE increasing.
22574	PRINTs number of free bytes.	27636	'BASIC TEXT TELCOM ADDRSS SCHEDL Suzuki Hayashi'
22580	PRINTs 'Select:' and responds appropriately to input.	27721	BASIC (as called from MENU)
23128	PRINTs starting at address in HL until a zero byte is reached.	27795	Temporarily saves the function keys.
23164	Sets up function keys.	27804	Restores the function keys.
23273	Months stored in ASCII.	29156	Adds a character to the keyboard buffer.
23312	'Microsoft'	29250	Returns ASCII of keypress in the accumulator; does not wait-returns 0 if no keypress.
23332	'Select:'	29301	SOUND routine. DE contains pitch, and B contains duration.
23366	Original key definitions stored here. FILES LOAD " SAVE " RUN LIST MENU	29772	Turns on the pixel (x,y) where D contains x and E contains y.
23400	ADDRSS (program)	29773	Turns off the pixel (x,y) where D contains x and E contains y.
23407	SCHEDL (program)	30326	Toggles the speaker.
23450	PRINTs 'Not found press space bar for menu'	30306	Equivalent to BEEP.
23758	ADDRS.DO	30481	Character set 5-bytes each.
23767	'Not found'	31729	Keyboard matrix
23852	'Call'	32051	Initialization
23920	PRINTs date and time at top of screen and updates it until a key is pressed.	32231	Initialize pointers (cold start)
24046	TEXT (program)	32422	PRINTs TRS-80 logo.
24051	Requests a file to edit.	32420	PRINTs number of free bytes.
24085	'File to edit'	32523	MAX FILES=
24106	'FIND LOAD SAVE COPY CUT SEL MENU'	32664	' bytes free'
24145	EDIT (program)	32676	TRS-80 logo stored in ASCII.
24367	Waits for a space keypress and then returns.	40960-62959	User RAM in 24K machine.
24376	'Text ill-formed'	62964+	HIMEM value.
24395	'Press space bar for TEXT'	62966	Code called at 32145 and 32197.
24753	'Memory full'	62969	RAM vector for RST 5.5.
26051	Moves memory starting at address in HL to address in DE until a 0 byte is reached.	62972	RAM vector for RST 6.5.
26062	'No Match'	62975	RAM vector for RST 7.5.
26071	'String'	62978	JMP 5169
26300	'Width'	62981	Code called at 32108 and 32292.
26421	'Save to:'	62991	Code called at 096.
26579	'Load from:'	63012	Code
		63024	8-bytes KEY ON/OFF flags; ON=1

Table 1 continued

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OFF=0

63033 Vertical Print position 0 to 7.

63034 Next horizontal print position 0-39.

63035 Number of active lines 0-8.

63036 Number of active columns 0-40.

63037 Label line flag; 0=unused, 255=used.

63038 Inhibits return to first line if not zero.

63040 Cursor line.

63041 Horizontal print position.

63040 Reverse video if not zero.

63054 x-pixel set.

63055 y-pixel set.

63063 Power-down value (constant).

63070 Code (to 63070)

63079 OUT/INP self-modifying code.

63090 Error code

63092 Value of LPOS

63093 Output flag; 0=display, 1=printer.

63096+ Top of available RAM.

63090+ Current BASIC line number; 65535 stored here if no program is running.

63100+ Start of current BASIC program text.

63104 End of statement marker (: OR 0)

63105 Multi-purpose buffer area. Tokenized text starts at 63105. Input buffer starts at 63109 and extends to 63362.

63360 Value of POS

63369 Function key definitions currently active. (extends to 63497)

63490 Function key definitions used by BASIC. (extends to 63626)

63628+ Pointer to start of PASTE text.

63639 Start of work area.

63705 Day of the month low digit here, high digit in 63706.

63707 Current day of the week (e.g. 3=wed.)

63788 Current month - decimal 1 to 12.

63709 Current year stored with low decimal value here and the high decimal value in 63790

63791 Timer; decreases from 125 to 0.

63792 Timer decreases from 12 to 0.

63793 Power-down countdown value (varies).

63795 The computer stores the current time starting here with the low digit of the number of seconds. A numerical value - not ASCII.

63796 The high digit of number of seconds.

63797 Low digit of number of minutes.

63798 Time and date continues here with one decimal value per location.

63005 6-byte value of TIMES for ON TIMES statement (in reverse order).

63812 COM ON/OFF flag.

63813+ Address of COM ON routine.

63815 TIMES ON/OFF flag.

63816+ Address of TIMES ON routine.

63818 ON/OFF flag and routine address

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Table 1 continued

of function keys; 3 bytes per key. (extends to 63841)

63842 Files in the format: address, 6-character name, 2-byte extension

63898+ Address of BASIC program that has not been saved to RAM. (Suzuki)

63909+ Address of Hayashi, points to the end of documents.

64173 Label line enable flag; enabled if not zero.

64175 Name of IPL program.

64198+ Used for temporary storage of stack pointer.

64208+ Length of CLOADED/CSAVED program

64357 BASIC variable type.

64404+ Line number of active DATA statement.

64409+ Location of BASIC variable for assignment statement.

64411+ Start of current BASIC statement

64413+ 2 less than value in 63896-63897

64415+ Line where error occurred.

64417+ Most recently entered/listed line

64419+ Location of statement where error occurred.

64421+ Location of ON ERROR GOTO line.

64423 Error status flag.

64424+ End of BASIC expression.

64426+ Line where Break occurred.

64428+ Location after error (contains 8 or 58).

64430+ Start of documents.

64434+ Start of variables.

The region from 64536 to 64648 is used for floating point computations.

64536 PAC1 (floating point accumulator) 8-bytes.

64617 PAC2 (floating point accumulator) 8-bytes.

64642 Maxfiles.

64659 Name of current BASIC program; 6-bytes.

64668 Name of program loaded from tape; 6-bytes.

64984 Start of date and time stored in ASCII. Used for Menu display. Not used for TIMES\$.

65024 Start of screen memory.

65348 Sound flag; on=0, off=175.

65349 Cassette on/off flag.

65424 Holds the value 2 as long as a noncontrol key is held down.

65429 Devoted to the number keys. Also uses location 65430

65431 Bits are set here according to which of the following keys are pressed: SPACE,DEL,TAB,ESC,PASTE,LABEL,PRINT,ENTER.

65432 Pressing a function key sets the corresponding bit in this location.

65441 Behaves like 65432.

65442 The following keys set bits in this location: SHIFT,CTRL,GRPH, CODE,NUM,CAPS LOCK.

65446 Code (not ASCII) for most recently pressed key.

65450 Number of characters in keyboard buffer.

65451 Keyboard buffer (32 byte maximum) Odd bytes contain ASCII values. A 255 in an even byte indicates a function key.

65515 Used to store 5-byte character code.

Token	Keyword	Token	Keyword	Token	Keyword
128	END	171	DATES	213	AND
129	FOR	172	DAYS	214	OR
130	NEXT	173	COM	215	XOR
131	DATA	174	MDM	216	EQV
132	INPUT	175	KEY	217	IMP
133	DIM	176	CLS	218	MOD
134	READ	177	BEEP	219	\
135	LET	178	SOUND	220	>
136	GOTO	179	LCOPY	221	=
137	RUN	180	PSET	222	<
138	IF	181	PRESET	223	SGN
139	RESTORE	182	MOTOR	224	INT
140	GOSUB	183	MAX	225	ABS
141	RETURN	184	POWER	226	FRE
142	REM	185	CALL	227	INP
143	STOP	186	MENU	228	LPOS
144	WIDTH	187	IPL	229	POS
145	ELSE *	188	NAME	230	SQR
146	LINE	189	KILL	231	RND
147	EDIT	190	SCREEN	232	LOG
148	ERROR	191	NEW	233	EXP
149	RESUME	192	TAB(	234	COS
150	OUT	193	TO	235	SIN
151	ON	194	USING	236	TAN
152	DSKOS	195	VARPTR	237	ATN
153	OPEN	196	ERL	238	PEEK
154	CLOSE	197	ERR	239	EOF
155	LOAD	198	STRINGS	240	LOC
156	MERGE	199	INSTR	241	LOF
157	FILES	200	DSKIS	242	CINT
158	SAVE	201	INKEY\$	243	CSNG
159	LFILES	202	CSRLIN	244	CDBL
160	LPRINT	203	OFF	245	FIX
161	DEF	204	HIMEM	246	LEN
162	POKE	205	THEN	247	STR\$
163	PRINT	206	NOT	248	VAL
164	CONT	207	STEP	249	ASC
165	LIST	208	+	250	CHR\$
166	LLIST	209	-	251	SPACE\$
167	CLEAR	210	*	252	LEFT\$
168	CLOAD	211	/	253	RIGHT\$
169	CSAVE	212	^	254	MID\$
170	TIMES				

* Basic reads ELSE as :LSE, with LSE = 145.

Table 2. Basic keywords and tokens.

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ROBOT ARM
'29**

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FX-80.....SAVE
RX-80.....SAVE
FX-100.....SAVE

**TRS-80 PRINTERS
COMPLETE LINE FROM '199**

**SCM SMITH
CORONA**

**TP-1 DAISY
WHEEL
PRINTER
FROM \$CALL**

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**GEMINI
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TELEMARKET DEPT. #4

—Make Your Own Modem Cable—

by Carl Oppedahl

While the Radio Shack modem cable for the Model 100 comes with one free hour each of CompuServe and Dow Jones services, this may be of little use to you if you already subscribe, or if you need more than one modem cable. For these reasons I built my own.

The circuit diagram for the Radio Shack cable appears in Table 3. One end is an exotic 8-pin DIN plug (see Photo 1) whose spacings are slightly different from those of the 8-pin cassette DIN plug. Look closely at the top panel of the Model 100: The difference lies in the placement of pins 6, 7, and 8. In the phone jack pins 7 and 8 sit directly below 1 and 3, while in the cassette jack pins 6, 7, and 8 are somewhat closer together.

Extending from the 8-pin plug are two conventional-looking modular telephone line cords. You would connect the beige cord to the local phone company dial tone, as with a wall jack, and the silver cord to a conventional telephone if you were using the computer as an automatic dialer for voice calls.

Unplug the modem cable from the Model 100, and the telephone connected to the silver cord will go dead. So Radio Shack provides a shorting connector to mate with the 8-pin plug in place of the Model 100. It connects pins 1 and 7, temporarily making the modem cable into a rather expensive telephone extension cord.

But with a bit of drilling and soldering, you can make your own cable at a cost of only a few dollars. Even if you buy all the parts new from Radio Shack and want to duplicate all the functions, including autodialing for voice telephone calls, you'll spend only \$10.88. (See Table 4.)

Since you need only pins 1, 3, and 7 (and you can omit pin 1 if you don't need the silver cord) you can pry loose one of pins

2, 4, or 5 to be used in position 7. However, it's difficult to remove pins from the black plastic. I ended up buying an extra 5-pin DIN plug, and simply cracked apart the plastic to get a spare pin to mount into a newly-drilled hole in the other.

After you extract an extra pin from a DIN plug, drill a hole in the 5-pin plug so that you can insert the new pin and glue it in place. This requires a 5/64-inch drill bit and a steady hand. Before drilling, slip off the plastic sleeve of the DIN plug by lifting the tab above pin 2. Then separate the two halves of the metal barrel inside. This exposes the black plastic carrier containing the five pins, which requires a hole for the new pin 7. The important thing is to drill the hole directly below pin 1, so that the new pin 7 fits into the matching hole in the Model 100 phone jack.

Then, mix up some epoxy glue. (I used a brand that sets in 10 minutes with satisfactory results.) Grasp the extra pin with a tweezer or needlenose pliers, apply glue to it with a toothpick, and insert it carefully into the hole. (See Photo 2.) Hold it parallel to the other pins until the glue has hardened somewhat. Then let it set for the period recommended in the glue instructions.

Next take the modular phone cord and cut it in half. Taking one half, carefully remove about an inch of the outer jacket. Inside you'll find green, red, and probably black and yellow wires. Clip the yellow and black wires (if any) short and strip the red and green wires, which carry what the telephone com-

DIN pin	Modular plug
1	grey cable, green wire
2	NC
3	grey cable, red wire, and beige cable, red wire
4	NC
5	NC
6	NC
7	beige cable, green wire
8	NC

Table 3. Connections in Radio Shack Model 100 modem cable.

Part Description	Current Price
Two 5-pin DIN plugs, part number 274-003	\$1.49
Telephone line cord, part number 279-374	\$4.95
Inline coupler, part number 279-358	\$2.95

Table 4. Parts list for homemade modem cable.



Photo 1. Radio Shack 8-pin DIN plug.



Photo 2. 5-pin DIN plug with new pin 7.



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26-4517	Profilis II Plus Upgrade	102
26-4521	Time Accounting	424
26-4532	MerCalc	264
26-4528	Electronic Broker	254
26-4531	SCRIPT 2.0	189
26-4532	SCRIPT5 Utility Disk	42
26-6304	SCRIPT5 Dictionary	42
26-6306	SCRIPT5 Printer Driver	42
26-4540	Statistical Analysis	254
26-4540	Logistics Support	85
26-7806	Accounts Receivable	107
26-4555	Menu Generator	33
26-4555	Profile Forms	126
26-4557	Profile Archive	126
26-4556	Profile Planner	126
26-4556	Protocol	211
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26-4802	Inventory Control System	254
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26-4782	EMASC		394
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26-6403	COBOL		587
26-6457	EMASC		254
26-6480	EMASC, Model 18 & XENIX		69
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Photo 3. The red wire goes to pin 3, while the green wire goes to pin 7.



Photo 4. Completed modem cable.

pany calls "ring" and "tip" signals, respectively.

Thread the DIN plastic sleeve onto the phone cord so that later you can slip it onto the DIN plug. Then solder the cord to the plug, connecting the red wire to pin 3 and the green wire to pin 7. Reassemble the metal barrel. (See Photo 3.) Slide the sleeve back on, and the cable should be ready to test. (See Photo 4.)

Testing the cable is easy. If you have access to an ohmmeter, use it to check that none of the DIN pins is shorted to any other, and that none of the modular plug pins is shorted to any other. Then check for continuity along the modem cable—the red wire at the modular plug should connect with pin 3 at the DIN plug, while the green wire should go to pin 7. Then plug the modem cable into the computer and the telephone line.

Call your local Radio Shack store to get the telephone number for Tymnet or Telenet. With the computer in TELCOM, dial that number on an extension phone, and when you hear the high-pitched carrier tone, push F4. Words and letters should appear on the screen. Then push F8, the Bye key, and type Y. The tone should stop. ■

Carl Oppedahl can be reached at 99 Park Ave., New York, NY 10016.

Program Length

by Ronald F. Balonis

Length.BA, an 8K RAM utility program, provides a method to compute program length in order to manage memory space on the Model 100. (See Program Listing 1.)

All memory references are in decimal notation. The user menu directory is located in RAM memory from 63930 to 64139, with each entry using 11 bytes. The first byte of each entry denotes the type of file: 0 is for a killed/empty file, 128 is for Basic program (.BA) files, and 192 for text (.DO) files. The next 2 bytes are the start address of the file in RAM memory, and the remaining 8 bytes are the file name and extension. Disassembly of the file area indicated that 26 is the end of file (EOF) indicator of a text file, and the standard string of three zeros is EOF for a .BA file.

The program conducts a sequential search of the directory for a file match, and then a sequential search of the file for the EOF byte, using PEEKs to read the memory. The menu directory search, while slow, proved acceptable, but the EOF search of the file had a tiresome wait with long files. This was an application in need of some machine language, and so I made my first attempt at a machine-language subroutine on the Model 100.

Borrowing on early Model I techniques, I fashioned a simple machine-language sequential search routine for the EOF search. The program loads it into the Model 100 with data statements, and the Basic PEEK and POKE statements pass the variables to and from the routine. A word or two of warning about my experience with machine language on the Model 100 is in order: Errors, at least of the types I made, cause the computer to do a cold restart, erasing all of the user programs.

Program Operation

Line 15 clears string space and reserves 50 bytes (from MAX-
RAM to HIMEM 63960 to 63910) for the machine-language subroutine. Lines 30-50 POKE the machine-language program (see Program Listing 2) into this memory space.

Lines 100-180 prompt for a file name, test that it has a valid formation, then construct a menu directory match string of it. The program stores the file names in the menu directory without the period before the extension, with the name left-justified and the extension right-justified, and with spaces filling the middle if necessary. Lines 200-260 do the sequential search of the menu directory using the PEEK function to create a match string. Line 205 tests for a killed/empty file, and line 225 tests for a match of file names. If a match is found, then lines 230-235 get its address. Line 310 passes this address to the machine-language program for the EOF search called in line 320 or 330. Lines 400-430 compute and display the results.

The utility program is simple to use. Just enter a valid file name and in two to three seconds the program displays its length for logging. Press the space bar for another program or to exit. ■

Write to Ronald F. Balonis at 118 Rice St., Trucksville, PA 18708.

```

5 'LENGTH.BA FIND LENGTH OF A PROGRAM
10 'BY R.F.BALONIS JULY 16, 1983
15 CLEAR 100,MAXRAM-50:'JULY 17, 1983
20 TITLES="LENGTH OF A PROGRAM"
25 '-MACHINE LANGAUGE PROG. END SEARCH-
30 FOR I=62911 TO 62958
40 READ Z:POKEI,Z:B$=B$+" "
50 NEXT I
60 DATA 0,0,229,42,191,245,43,
35,126,254,26,194,190
70 DATA 245,195,234,245,229,42,
191,245,43,35,126,254
80 DATA 0,194,213,245,35,126,254,
0,194,213,245,35
90 DATA 126,254,0,194,213,245,
34,191,245,225,201
95 '
100 B$="":FNM$="":ADRS=0
110 CLS:PRINT@10,TITLES
120 PRINT@02,"ENTER NAME AS IT APPEARS
ON THE MENU"
130 PRINT@165,"<ENTER> TO EXIT ";
135 INPUT FNM$:IF FNM$="" THEN MENU
140 I=INSTR(FNM$,"."):TYPE$="":TYPE=0
145 IF I=0 THEN 100
150 TYPE$=MID$(FNM$,I+1,2)
155 IF TYPE$="DO" THEN TYPE=1
160 IF TYPE$="BA" THEN TYPE=2
165 IF TYPE=1 OR TYPE=2 THEN 170
ELSE 100
170 FILN$=LEFT$(FNM$,I-1)
175 IF LEN(FILN$)<6 THEN FILN$=FILN$+"
":GOTO 175
180 FILN$=FILN$+TYPE$
185 PRINT@205,"**** SEARCHING DIRECTORY
****";
190 '
195 '---SEQUENTIAL DIRECTORY SEARCH---
200 FOR I=63930 TO 64139 STEP 11
205 B$="":IF PEEK(I)=0 THEN 240
210 FOR II=3 TO 10
215 B$=B$+CHR$(PEEK(I+II))
220 NEXT II
225 IF INSTR(B$,FILN$)<1 THEN 240
230 IL=PEEK(I+1):IH=PEEK(I+2)
235 ADRS=IH*256+IL:I=64139
240 NEXT I
245 IF ADRS=0 THEN 250 ELSE 290
250 PRINT@205," **** NOT IN DIRECTORY *
*** ";
260 FOR I=1 TO 1000:NEXT I:GOTO 100
280 '
290 '---FIND THE LENGTH---
300 PRINT@205," **** COMPUTING LENGTH *
*** ";
310 POKE62911,IL:POKE62912,IH
320 IF TYPE=1 THEN CALL 62913
330 IF TYPE=2 THEN CALL 62928
340 '
400 CLS:PRINT@10,TITLES
405 IADR=PEEK(62912)*256+PEEK(62911)
410 PRINT@163,"< FNM$ > IS "IADR-ADRS"
BYTES LONG"
420 PRINT@207,"**** PRESS <SPACEBAR> ***
*";
430 IF INKEY$="" THEN 100 ELSE 430

```

Program Listing 1. Length.BA—utility.

	Memory Address	Source Statement	Object Code
L. Addr	62911		0
H. Addr	62912		0
DO Entry	62913	Push HL	229
	62914	LD HL, 62911	42,191,245
	62917	Dec HL	43
	62918	Inc HL	35
	62919	LD A, (HL)	126
	62920	Cp 26	254,26
	62922	JNZ 62918	194,198,245
	62925	JP 62954	195,234,245
BA Entry	62928	Push HL	229
	62929	LD HL, 62911	42,191,245
	62932	Dec HL	43
	62933	Inc HL	35
	62934	LD A, (HL)	126
	62935	Cp 0	254,0
	62937	JNZ 62933	194,213,245
	62940	Inc HL	35
	62941	LD A, (HL)	126
	62942	Cp 0	254,0
	62944	JNZ 62933	194,213,245
	62947	Inc HL	35
	62948	LD A, (HL)	126
	62949	Cp 0	254,0
	62951	JNZ 62933	194,213,245
	62954	LD 62911, HL	34,191,245
	62957	Pop HL	225
	62958	Return	201

Program Listing 2. Length.BA—machine language.

Blackjack

by Paul Serotta

Blackjack isn't a mere conversion: This program uses the Model 100's unique features—graphics, sound, and interrupt-controlled function keys—to simulate the popular casino card game also known as 21. Like the Vegas version, the game program pits a single player against the house's dealer (the Model 100). The object of the game is to accumulate a hand worth 21 points, or as close to 21 as possible, without going over. The house wins if you draw over 21, or if the dealer's hand is closer to 21 than yours is.

The 8K program starts by asking you to type in your name and press the enter key. From now on, it addresses you personally. The program gives you a stake of \$1,000 and asks you to enter your bet. Should you decide to wager the entire amount on the first hand, the buzzer sounds and the program applauds your bravado with an encouraging "Go for it!"

Conversely, a low bet (under \$100) merits the program's disdainful "You are cheap!"

After you've entered your bet (in full-dollar amounts only), four boxes appear on the screen. The two upper boxes represent your first two cards; a typical deal might be a king of clubs and a six of hearts. In the lower right-hand box the program displays the dealer's first card, for example, a six of spades. You then have the following options, selected with the 100's function keys: hit, double, stay, and quit. Press the F1 key if you want another card, the F2 key if you want to be dealt another card and double your original bet, the F3 key to play a two-card hand against the dealer, or the F4 key to stop the game altogether.

When you stay, you're electing to play your current hand against whatever the house turns up for itself. The program then keeps dealing itself more cards until it has reached 21—an automatic win, beaten your hand, or gone over. If you lose, the program tells you "You are busted." If you win, it admits "I'm busted—you win!" Should the dealer's hand match your own, the program declares the deal a draw or "push" and no one wins or loses.

The program keeps a running tally of your stakes; after each deal it reminds you of how much money you have available and asks you to enter another bet.

It's impossible to cheat at this Blackjack, by the way. Try wagering more money than you have in your purse or doubling at the wrong time, and the program calls you on it.

When you decide to bail out, press the F4 key and the program totals your winnings—or your losses.

There's one born every minute. ■

Contact Paul Serotta at 131 Penrose Drive, Pittsburgh, PA 15208.

Program Listing 3. Blackjack.

```
10 REM *****
20 REM          BLACKJACK
30 REM
40 REM PAUL SEROTTA
45 REM 131 PENROSE DR.
50 REM PITTSBURGH, PA 15208
55 REM
60 REM *****

80 REM
99 REM DIMENSION CARD ARRAY, SET
  PLAYER'S AMOUNT OF MONEY
100 DIM C(52):PM=1000
105 REM CLEAR FUNCTION KEYS (F1-F4)
110 FOR LL=63369 TO 63432:POKE LL,0:NEXT LL
112 REM TITLE PAGE
115 CLS:LINE(70,24)-(115,52),1,B:LINE(
  120,24)-(165,52),1,B:PRINT@173,"ACE
  ";PRINT@181,"JACK ";
125 GOSUB 9000:CLS:PRINT@121,"PLEASE
  TYPE YOUR NAME AND PRESS 'ENTER'"
140 PRINT:LINE INPUT N$:GOSUB 9000
145 KEY OFF:IF PM<=0 THEN GOTO 3000
147 REM INITIALIZE LOGIC VARIABLES & ASK
```

```
FOR BET
150 PP=1:CS=2:PA=0:CA=0:PT=0:CT=0:CR=2:
  PC=01:CP=201:GOSUB 9020:PRINT:PRINT N$;"
  YOU HAVE $";PM
160 PRINT@200,"";:INPUT"PLEASE ENTER
  YOUR BET";BET:BET=INT(BET)
170 IF BET>PM THEN GOSUB 9050:GOTO 160
180 IFSGN(BET)=-1 ORSGN(BET)
  =0 THEN GOSUB 9050:GOTO 160
190 IF BET=PM THEN PRINT@293,CHR$(27);"p";"
  GO FOR IT !! ";CHR$(27)
  ;"q";:SOUND 4000,15:SOUND 3000,10:SOUND 200
  0,8:FORDL=1 TO 500:NEXT DL
195 IF BET<100 AND PM>500 THEN PRINT@291,CHR$(
  27);"p";" YOU ARE CHEAP !! ";CHR$(27)
  ;"q";:SOUND 4000,30:SOUND 12000,30:FORDL=1
  TO 500:NEXT DL
200
GOSUB 9020:GOSUB 9100:GOSUB 9110:PP=1:GOSUB
  9500:ONKEY GOSUB 1000,4000,2000,3000
202 PRINT@100,CHR$(155);"
  YOU";:PRINT@220,CHR$(155);"
  DEALER";:FORDL=1 TO 300:NEXT DL:PRINT@100,S
  PACE$(6);:PRINT@220,SPACE$(9);
210 PRINT@PC,C$;CHR$(156+SU);:PC=PC+
  0:PT=PT+CV:GOSUB 9500:PT=PT+
  CV:PRINT@PC,C$;CHR$(156+SU);:PC=PC+0
215 IF PA=2 THEN PA=1:PT=PT-10
220 PP=0:GOSUB 9500:HC$=C$+CHR$(156+SU)
  :CT=CT+CV:CP=CP+0:GOSUB 9500:CT=CT+
  CV:PRINT@CP,C$;CHR$(156+SU);:CP=CP-0
225 IF CA=2 THEN CA=1:CT=CT-10
230 IF PT=21 AND CT<>
  21 THEN PRINT@CP,HC$;:PRINT@280,"BLACKJACK
  !!!!!!";:PM=PM+BET+INT
  (BET/2)
  :FORDL=1 TO 5:SOUND 4000,10:SOUND 0000,10:NE
  XTDL:GOTO 145
240 IF CT=21 AND PT<>
  21 THEN PRINT@CP,HC$;:PRINT@280,"I HAVE
  BLACKJACK $$$! - YOU LOSE ";:PM=PM-
  BET:SOUND 14000,15:SOUND 16000,20:FORDL=1
  TO 1000:NEXT DL:GOTO 145
250
  IF CT=21 AND PT=21 THEN PRINT@CP,HC$;:GOTO 221
  0
260 KEY ON
270 PRINT@200,"BIT DBL STAY
  QUIT";:FOR WW=1 TO 200:NEXT WW:PRINT@200,SPA
  CE$(39);:FOR WW=1 TO 200:NEXT WW
280 IF NH=1 THEN NH=0:GOTO 145:ELSE GOTO 270
999 REM PLAYER BITS
1000 CR=CR+1
1010 IF CR=3 THEN LINE(94,9)-(142,30)
  ,1,B:GOTO 1050
1020 IF CR=4 THEN LINE(141,9)-(189,30)
  ,1,B:GOTO 1050
1030 IF CR=5 THEN LINE(180,9)-(236,30),1,B
1050 PP=1:GOSUB 9500:PRINT@PC,C$;CHR$(
  156+SU):PC=PC+0:PT=PT+CV
1060 IF PT>21 AND PA<=0 THEN PRINT@200,N$;"
  YOU ARE BUSTED
  ";:FORDL=1 TO 10:SOUND 12000,DL:NEXT DL:PM=PM-
  BET:FORDL=1 TO 500:NEXT DL:NH=1:RETURN
1070 IF PT>21 AND PA<=0 THEN PA=PA-1:PT=PT-10
1100 IF CR<>5 THEN RETURN
1200 PRINT@200,"5 CARD CHARLIE - YOU WIN
  !!!";:FORDL=1 TO 0:SOUND 5000,DL:SOUND 15000,
  DL:NEXT DL:PM=PM+BET+INT(BET/2)
```

Listing 3 continued

Listing 3 continued

```

:NH=1:RETURN
1999 REM COMPUTER'S LOGIC
2000 KEY OFF
2005 PRINT@200,SPACE$(30);
2010 PP=0:PRINT@CP,BC$:CP=CP+16
2020 WC=94: IFCT>16THEN2200
2050 CS=CS+1:
IFCS=6THENGOTO2206:ELSELINE(WC,32)-(WC+
40,53),1,B:GOSUB9500
2060 WC=WC+47:CT=CT+CV:PRINT@CP,C$;CHR$(
156+SU);:CP=CP+0
2070 IFCT>21 AND CA>0 THENCA=CA-1:CT=CT-
10
2075 IFCS=6ANDCT<22THENGOTO2206
2080 IFCT<=16THEN2050
2199 REM WHAT HAPPENED?
2200 IFCT>21THENPRINT@200,"I'M BUSTED --
- YOU WIN
11";:SOUND14000,20:SOUND10000,20:SOUND50
00,20:SOUND3500,20:PM=PM+BET:GOTO2500
2206 IFCS>=5THENPRINT@200,"I'VE GOT A 5
CARD CHARLIE -- YOU LOSE";:PM=PM-
BET:SOUND7500,20:SOUND5000,15:SOUND10000
,20:GOTO2500
2210
IFCT=PTTBENPRINT@200,"PUSH.....
";:FORDL=7000TO10000STEP1000:SOUNDDL,0:N

```

```

EXTDL:GOTO2500
2220 IFCT>PTTBENPRINT@280,"I WIN
$$$$$$$$";:SOUND16000,25:PM=PM-
BET:GOTO2500
2230 IFCT<PTTBENPRINT@200,"YOU WON
1111";:SOUND3000,20:SOUND0000,20:SOUND3
000,20:PM=PM+BET
2500 FORDL=1TO1250:NEXTDL: IFCO>
25THENGOSUB9100
2505 NB=1: RETURN
2999 REM QUIT
3000 CLS:PRINT@00,"BYE ";N$:IFPM>
=1000THENPRINT@200,"YOU WON $";PM-
1000:END:ELSE
3010 PRINT@200,"YOU LOST $";ABS(PM-1000)
:END
3999 REM PLAYER DOUBLES
4000 IFCR>2THENPRINT@200,"YOU CAN'T
DOUBLE NOW --- DUMMY
11";:SOUND7500,20:SOUND13000,20:FORDL=1T
O1000:NEXTDL:PRINT@200,SPACE$(30)
;:RETURN
4002 IFBET*2>PMTBENPRINT@200,"YOU DON'T
HAVE ENOUGH MONEY ****
";:SOUND3000,10:SOUND15000,10:SOUND0000,
10:FORDL=1TO1000:NEXTDL:PRINT@200,SPACE$
(35);:RETURN

```

Listing 3 continued

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Listing 3 continued

```

4005 PP=1:CR=CR+1:LINE(94,9)-(142,30)
,1,B:GOSUB9500
4010 PRINT@PC,C$;CHR$(156+SU):PT=PT+
CV:BET=BET*2
4020 IFPT>2LANDPA=<0THENGOTO1060
4030 IFPT>2LANDPA>0THENPT=PT-10
4050 GOTO2000
0999 REM PRINT WELCOME
9000 FORLL=1TO5:PRINT@50,"WELCOME TO
";CHR$(27);"p";"BLACKJACK";CHR$(27);"q"
9010 FORDL=1TO60:NEXTDL:BEEP:
PRINT@50,SPACE$(20)
;:FORDL=1TO60:NEXTDL,LL:RETURN
9015 REM PRINT NAME OF GAME ON FIRST
LINE
9020 CLS:LINE(0,0)-(239,7)
,1,BF:PRINT@15,"BLACKJACK":LINE(0,7)-(
239,7):RETURN
9030 REM ANY CHEATING ??????
9050 PRINT@200,"NO CHEATING IN THIS GAME
!";SOUND4000,10:SOUND10000,10:SOUND1600
0,10
9060
FORDL=1TO750:NEXTDL:PRINT@223,SPACE$(96)
;:RETURN
9099 REM SHUFFLE THE CARDS
9100 CO=0:FORLL=1TO52:C(LL)

```

```

=1:NEXTLL:RETURN
9105 REM DRAW THE INITIAL 4 CARDS
9110 LINE(0,9)-(40,30),1,B:LINE(47,9)-(
95,30),1,B:LINE(0,32)-(40,53),1,B:LINE(
47,32)-(95,53),1,B
9115 RETURN
9499 REM PICK A CARD
9500 SEC=VAL(RIGHT$(TIME$,2))
:FORI=1TOSEC:DUM=RND(1):NEXTI:RN=INT(RND
(1)*53)
9510 IFC(RN)=0THEN9500
9520 CO=CO+1:C(RN)=0:SU=RNMOD4:
9530 IFRN>4THENGOTO9535:ELSEC$="ACE
":CV=11
9532 IFPP=1THENPA=PA+1:ELSECA=CA+1
9533 GOTO9600
9535 IFRN>4THENGOTO9540:ELSEC$=STR$(INT
(RN/4))+":CV=INT(RN/4)
9537 IFRNMOD4<>0THENC$=STR$(INT(RN/4)+1)
+"":CV=INT(RN/4)+1
9530 GOTO9600
9540 IFRN<45THENC$="JACK
":CV=10:GOTO9600
9545 IFRN<
49THENC$="QUEEN":CV=10:GOTO9600
9550 C$="KING":CV=10
9600 RETURN

```

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Monitor 100 Changes

I found the "Monitor 100" program (August 1983, p. 17) particularly interesting, but to make it work I had to make two changes to the printed version.

First, statement 58 is redundant and should be deleted. Also, in line 200, MID\$(0\$,3,4) should be MID\$(0\$,2,4).

The Model 100 is an excellent complement to my big computer (a Kaypro II set up as an RCPM/RBBS). I can prepare draft documents on the go, then capture the incoming text file to disk.

A Basic program on the Kaypro (ADDLF.BAS) adds a line feed at each carriage return (required by CP/M and many non-TRS-80 computers). You can then print the resulting file as is, or process it further on your home computer. You can upload Model 100 Basic programs in a similar manner if you save them in ASCII format.

I use an Epson MX-80 printer. Its ability to skip over perforations by either software command or hardware switch lets you paginate documents created on the Model 100 without the intermediate step of uploading to a more powerful computer.

Anyone buying a printer for the Model 100 should look for this feature, as well as the capability to add line feeds (a hardware switch option on the MX-80).

The usefulness of the Model 100 is enhanced by the series of features initiated in your July issue. Although it is not the primary use of this computer, methods of installing machine language code would be a good subject for a future article.

Phil Wheeler
5539 Towers St
Torrance, CA 90501

Foxfighter Glitch

I just bought my first copy of *80 Micro*, and I'm delighted to find the C*Notes section dedicated to the Model 100. I am satisfied with my Model 100, but until recently thought that no one was writing software for it.

I enjoyed the Foxfighter program (August 1983, p. 200) but I did find a couple of glitches in it.

The program always presents one of seven predefined screen displays for the air mines. This becomes routine after a little while and encourages high scoring.

The changes shown in lines 10 and 25-34 in Program Listing 1 display the air mines in random patterns instead. Occasionally this results in an invisible air mine or two, adding to the challenge of the game.

Line 10 sets the RND function to one of 60 different starting points based on the Model 100's built-in clock. Lines 25-34 use the RND function to display the air mines in various screens instead of the seven predefined screens used in the original listing.

Also, line 150 of Foxfighter is supposed to provide an additional fighter plane when the score reaches 500, 1,000, and 2,000. Actually, it only increments the number of fighters displayed by 1 at these three points. Lines 150-158 in Listing 1 change the number of fighters as well as the display.

Harold Shaver
509 Mulberry #6
Suisun, CA 94585

```
10 DIMX(6),A(42):V=3:SCR=0:
CLS:PRINT@92,"<<FOXFIGHTER>>":
PRINT:PRINT:FOR T=1 TO VAL(RIGHT$(TIME$,2))
:SEC=RND(1):NEXT:INPUT"DO YOU NEED
INSTRUCTIONS (Y OR N) " ;A$:IF A$="Y"
THEN 390 ELSE 20
25 FOR I=1 TO 42:READA(I): NEXT
30 FORM=1 TO 6
32 Y=INT(41*RND(1))+1:FOR I=1 TO
6:IFX(I)=A(Y) THEN32
34 X(M)=A(Y):NEXTM
150 IFSCR=500 AND
BN=0 THENV=V+1:BN=1:GOTO155ELSEIFSCR=1000
AND BN=0 THENV=V+1:BN=1:GOTO155ELSE IF
SCR=2000 AND BN=0 THENV=V+1:BN=1:GOTO
155
155 IF SCR<> 500 AND SCR <>1000 AND SCR
<> 2000 THEN BN=0
150 PRINT@0,V
```

Program Listing 1. Adjustments for Brad Dixon's "Foxfighter" program.

Calculator Program

The short calculator program in Program Listing 2 is one of the first programs I wrote on my Model 100.

To run the program, input a value and press the enter key. Then input either a plus (P), multiplication (.), subtraction (-), or division (/) sign.

Type in your next number and press the enter key. Now press the equals key to get an answer, or key in another function and continue calculating. Once you have an answer, you can start over, stop, or carry your balance forward.

By using P for addition and a period for multiplication, you don't need to use the shift lever.

Mark Fox
774 Hazelwood Drive
North Wales, PA 19454

```
5 CLS
6 PRINT"CALCULATOR PROGRAM"
10 INPUT Y
11 CLS
15 PRINTY
20 Y$=INKEY$:IF Y$="" THEN GOTO20
21 IF Y$="+" THEN100
25 PRINTY$
30 INPUT X
31 IF Y$="P" THEN Y=Y+X:GOTO20
32 IF Y$="*" THEN Y=Y*X:GOTO20
33 IF Y$="-" THEN Y=Y-X:GOTO20
34 IF Y$="/" THEN Y=Y/X:GOTO20
100 PRINT"-----"
200 PRINTY;" IS YOUR ANSWER"
210 PRINT
220 PRINT"ANOTHER EQUATION? OR BAL
FWD(Y,N,B)"
223 Z$=INKEY$
230 IF Z$="" GOTO 223
230 IF Z$="Y" THEN5
240 IF Z$="X" THEN5
250 IF Z$="B" THEN15
260 END
```

Program Listing 2. Model 100 Calculator program.

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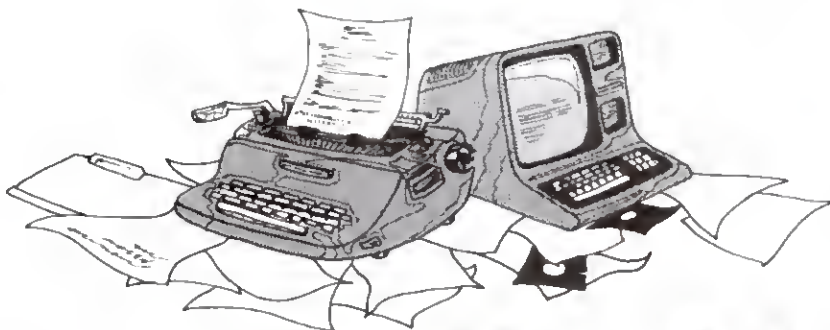
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NEWS THIS MONTH



14,000 miles with a Model 100

Steve Roberts' bicycle odyssey.

Anyone who's bought a TRS-80 Model 100 will tell you that the portable lets you work without being chained to a desk, but one owner is taking Tandy's "Micro Executive Work Station" idea far beyond an armchair or plane ride. Steve Roberts, a Columbus, OH, freelance writer, plans to conduct a year's business with his Model 100, without stepping into his office once.

In fact, most of the time he'll be lying down—on a custom-designed recumbent bicycle, festooned with generators and solar cells, which he'll pedal 14,000 miles across America.

On the road, Roberts will record his various writing projects using a helmet-mounted microphone and a portable tape recorder. After setting up camp, he'll transcribe his prose onto his 32K Model 100 and upload it via telephone to his main computer, a Micromax System 1000, in Columbus. Kacy Branstetter, Roberts' manager and editor, will be standing by to receive copy, forward phone calls, and serve as what Roberts calls his "interface with the universe."

Roberts' .DO files, he says, will make a pit stop between bike and Branstetter: The trip's primary sponsor, CompuServe Information Service, is supplying "essentially unlimited time and file-space" for uploading. CIS members are encouraged to chat with the rolling writer (his user ID number is 70007,362), and his saga will be available as a regularly updated data base: "I think you'll be able to just type GO SKR and it'll be there as a display file," Roberts predicted.

An on-line travelogue isn't Roberts' first high-tech writing assignment. A former software and systems consul-



Roberts: "I'll exist in a totally asynchronous fashion."

tant, the 31-year-old author turned to Words'worth Inc., a business communications firm, he alternates magazine ar-

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ticles and books (Prentice-Hall's *Creative Design with Microcomputers* and *Complete Guide to Microsystem Management*) with corporate technical writing assignments. The former, he told CompuServe's *Today* magazine editor Carole Gerber, offer "fame and glory," while the latter "[provide] steady income."

His bicycle trip is a shot at both. Interviewed two weeks before his scheduled Sept. 28 departure, Roberts told *80 Micro* he planned a 700-mile "shake-down cruise" around Indianapolis, IN, and Louisville, KY. Then, in early November, he'll begin his journey with a turn south from Washington, DC, toward Florida to start a clockwise loop of the U.S.

"I'm anticipating [the trip's taking] about a year, finishing up around the idea, of course, is to take advantage of as much good weather as possible."

In preparation for the voyage, Roberts said, he was wringing out both his Model 100 and his legs: "I'm basically living off the Model 100 now for everything. Between the Model 100 and CompuServe, my office is very light."

As for physical preparation, "The obscene part of all this is that I've been riding around central Ohio, which is very flat and [where it's] very easy to get cocky about your ability to go long distances. [But] unless there are physical problems I don't see any trouble. I may bust a knee and jettison all this high-tech equipment."

He's already jettisoned an item that would have spared him frequent visits to phone booths. Technical problems and the unit's weight aborted his plans to carry a second computer, a home-made CMOS CP/M system with 3½-inch microfloppies for mass storage; that leaves him the stock Model 100, no storage except RAM, and obligatory stops to upload every 15 pages or so.

"I'm hoping to get something that'll be useful for [bulk storage] fairly soon," Roberts admitted. "I've looked at wafertape drives, and I'm interested in what people are doing with 3½-inch floppies. If all else fails I have cassette, though I'm not crazy about it."

"If anyone comes up with more memory, I'm ready. I've talked a little to Holmes Engineering about the 256K bubble memory and it sounds like it's not quite ready, but that would be a worthwhile purchase if it comes out

sometime during the trip."

Meanwhile, he estimates that his cycle, camping gear, and electronics equipment total about 110 pounds, some taken up by a high-tech way to save batteries: "A couple of solar panels that were donated by Solarex provide 15 volts in full sun," he said, and another sponsor has contributed rechargeable Ni-Cad cells.

Besides relying on them, plus an ac line when available, Roberts has a generator similar to those that run bicycle headlights: "If I've got a good tailwind or I'm flying downhill, it's a simple matter to pop [the generator] against the wheel and get power."

There's one item he doesn't expect to use—a CB radio, carried in case of emergency. "I've stripped it down almost to just a PC board," Roberts said. "It's not even near me when I'm doing my regular writing, but if I'm crashed in a ditch somewhere I'd like to be able to call for help."

While the trip will challenge not only Roberts' stamina but the Model 100's—"how well it will do in the sun and vibration and dirt and everything else"—Radio Shack is keeping its distance from the project. "They know about it but seem kind of unresponsive," Roberts said when asked about any contact with Tandy. "I encountered such a huge, faceless organization when I [approached them] for a sponsorship that I went back to CompuServe."

That may be because Radio Shack is unwilling to share other people's publicity stunts. Roberts seems sincere and enthusiastic about the trip and eager to discuss it as an affirmation of new technologies' ability to liberate desk-bound workers, but the enterprise is not exactly free of Madison Avenue-style merchandising.

In addition to his CompuServe updates, there's the matter of what Roberts will write during his year on the road. Besides freelance magazine articles and material for corporate clients, he plans two books. One will be either a "boring but easy to write" text about on-line communications and engineering, or a computer science text which Roberts calls "potentially a huge money-maker but a lot of work."

Roberts' second and more important effort will be a book tentatively titled *Computing Across America: A Bicycle Odyssey*, for which his agent is currently negotiating with several publishers.

Suspicion of Roberts' making the trip in order to write about it, rather than making it and then writing about it, lessens the credibility of his words to *Today's* Gerber: "The whole trip offers an opportunity to test the viability of the information society. I want to see if I can maintain a heavily interactive, information-oriented professional practice involving a lot of clients [with] complete freedom from the confines of an office. I'll exist in a totally asynchronous fashion."

Also, Roberts' point is to be free from desks and papers, yet he'll be carrying generators and solar cells. Is that practical? "I think it is practical," he told *80 Micro*, "and I've been doing it on a very small scale recently as I've been practicing."

"I find I get a lot more done when I'm out on a beach or something with a Model 100. This morning, in fact, I wrote most of an article at a Wendy's restaurant while having breakfast. When I'm out of the office, there are fewer distractions and I can get more done."

This makes sense, but sounds more like most users' appreciation of the 100 as a handy notepad than a defense of a full-time career with one. Also, of course, Roberts' job fits his thesis better than most other professions would; the freelance writer is the most insecure financially, but the least place- and equipment-bound, worker there is.

Nevertheless, Roberts insists, his trip goes beyond both commercial aspects and his point about the open office. "If I wasn't writing for a living and had lots of money I'd be doing it anyway," he said. "The fact that I'm not independently wealthy forces me to work while I'm on the road, and [the 100's] a convenient way to do that."

"I don't think it is [a publicity stunt]. I've thought about it a lot and wondered if it was, and it doesn't feel that way. It's something I do privately as well as publicly."

And, anyway, Roberts' tour is an adventure. *Computing Across America* is unlikely to rival de Tocqueville's *Democracy in America* or William Least Heat Moon's *Blue Highways*, but Roberts' combination of gee-whiz Woodstock spirit and "Real People" PR might produce a bestseller.

How about *Zen and the Art of Model 100 Maintenance*? ■

—E.G.

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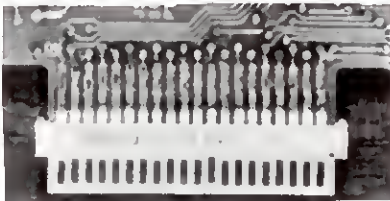
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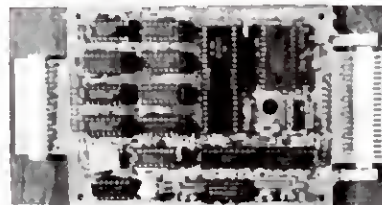
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SOFTWARE

ROM is copyright

Apple wins; Franklin to appeal.

Diving into a hazy maze of 0's and 1's, a federal appeals court in Philadelphia has issued a ruling that makes the question of software copyright one step clearer, even as it blurs the distinction between software and hardware.

On August 30, a three-judge panel upheld Apple Computer Inc.'s lawsuit against Franklin Computer Corp., allowing Apple to seek an injunction against sales of Franklin's Apple-compatible Ace 1000. The key decision: computer manufacturers can copyright operating systems and programs in ROM, as well as applications programs.

Writing that "the medium is not the message," Circuit Court Judge Darcy Sloviter overturned a lower court's denial of Apple's suit. Franklin admitted copying 14 operating system programs before the lower court, but argued that such programs embodied in chips are essential parts of the machine—hardware—and, as such, ineligible for copyright.

The presiding federal district judge agreed, finding that firmware was not written "in a language of description" and refusing to issue a temporary restraining order against Franklin. The appeals court's decision lets Apple return to district court and seek the injunction, even as Franklin's lawyer, James Shestack, announced plans to ask for a rehearing—round 3 of the battle, so to speak—before the entire Court of Appeals. Round 4 might take place in the U.S. Supreme Court.

In upsetting Franklin's claim that the programs were an uncopyrightable "process, system, or method of operation," Sloviter and his colleagues said that that approach "mistakenly focuses on the physical characteristics of the instruction," like paying attention to a book's ink and paper rather than its contents. "Apple," the panel declared, "does not seek to copyright the method which instructs the computer to perform its operating functions but only the instructions themselves."

"Franklin's attack on operating sys-

tem programs as 'methods' or 'processes' seems inconsistent with its concession that application programs are an appropriate subject of copyright," the court continued. "Both types of programs instruct the computer to do something."

"The statutory definition of a computer program...makes no distinction between application programs and operating programs. We reaffirm that a computer program in object code embedded in a ROM chip is an appropriate subject of copyright."

The decision makes an important distinction between the two legal means by which people protect their ideas—copyright and patent. As the *New York Times*' David E. Sanger wrote, "Under U.S. law, copyrights protect the expression of an idea, such as a literary work. Ideas themselves, in the form of novel inventions, are protected by patents."

In Franklin's view, Apple's operating programs were unpatented hardware, and therefore free for copying. Computer makers, Sanger pointed out, "have shied away from using the patent system to protect their programs," because patents take a long time to obtain and because "it is not clear whether most computer programs are sufficient-

ly novel and distinct from one another to merit patent protection."

For example, Scripsit and Newsprint, both TRS-80 word processors, are alike in many ways—generally, they're both written in 1's and 0's; more specifically, they use similar routines to perform similar tasks such as opening and closing files. Like two novels written with the same words, they are not different enough to be patented. They are, however, copyrighted by Radio Shack and Prosoft respectively.

As for Apple, the Cupertino, CA, firm's vice president and general counsel, Albert Eisentat, was naturally pleased with the ruling, telling *Computerworld*, "I think it's one of the most definitive statements of the law that's been done yet."

Whatever the odds, however, Franklin vowed to continue the fight. The Cherry Hill, NJ, company's executive vice president and chief operating officer, Avram Miller, told reporters, "Our plans right now are to go back to the court for redress. We believe we'll prevail and the injunction will be denied."

Added attorney Shestack, "We still contend that Apple was abusing the copyright laws to gain a monopoly on

As this issue went to press, Osborne Computer Corp. stopped production of its portable computers, laid off 300 of its 400 remaining workers, and filed for protection from creditors under Chapter 11 federal bankruptcy laws.

The Hayward, CA, firm employed 1,000 people before closing its New Jersey plant and beginning California layoffs last summer, plagued by more powerful and less expensive competitors to its Osborne I and delays in shipping its successor, the Osborne Executive.

On Sept. 12, two San Jose component suppliers filed a lawsuit claiming Osborne owed them more than \$4.5 million for circuit boards, disk drives, and other parts. The portable pioneer filed for Chapter 11 protection in U.S. Bankruptcy Court in Oakland on Sept. 13.

James Lopes, attorney for Osborne, told the Associated Press that three banks had agreed to loan the company \$600,000 while Osborne sought possible buyers or investors.

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equipment compatible with its machine."

Ekos Inc., a Franklin distributor, issued a press release affirming its support of the Ace manufacturer. Ekos President Steven R. Gerbsman declared, "There are other alternatives not yet explored, including royalty payments, that cause us to believe we'll be marketing Franklin computers for some time to come."

The mention of royalty payments indicates a possible direction for settlement, though no one's talking at pres-

ent; all Miller would tell *ISO World* was, "We have contingency plans if we fail."

One of Franklin's contingency plans is probably its IBM PC-compatible micro, being prepared under the direction of engineer William Sydnese, who designed the original PC and reportedly was working on IBM's Peanut when he moved to Franklin in April.

The Philadelphia ruling does not affect makers of IBM clones, because IBM's "open architecture" policy

makes details of its PC system readily available.

Nevertheless, the Apple/Franklin decision means that computer companies can protect all software—whether on a disk, a listing, or a chip, and in source or object code—by copyright. Manufacturers continue to worry about small-scale piracy and product backups, but system pirates have apparently been sunk. ■

—E.G.

BUSINESS

Waiting for Santa

The micro industry looks to the Christmas market.

After a summer of rollercoaster stock prices and grim predictions for TI and Atari, the microcomputer industry tried to pull itself into shape for the Christmas buying season. By September, some companies had asserted themselves as movers and shakers, some were on the move, and others were merely shaking.

Taking the latter first, Texas Instruments moved swiftly to reduce towering TI 99/4A inventories. A price cut to \$99 helped move the overstocked machine, and a peripheral package consisting of a disk drive and controller, 32K RAM expansion, and rack mount, was slashed from \$1,200 to \$550. In addition, stores received a free \$100 software package for every system ordered.

According to *Electronic News*, dealers immediately started selling the expansion package and software for as little as \$449, with industry observers predicting \$399 before long. Such a price, bringing a 48K disk system to around \$500, would be competitive, though other questions remained unanswered: whether buyers would be attracted to the software-scarce micro, and whether TI could survive at such a low (perhaps negative) profit margin.

Turning the knife in TI's wound, Montgomery Ward issued its 1983 Christmas catalog on September 9—and bumped the 99/4A to give space to Coleco's Adam.

Timex dealers had even less to smile about. Ken Coach, marketing and sales

director of Softsync, told *InfoWorld*, "The Timex-Sinclair 1000 has petered right out." Coach hoped that the forthcoming TS 2068, the U.S. version of the Sinclair Spectrum color machine, might share the under-\$200 market with Commodore, but saw no prospects for the black-and-white TS 1500: "I'm not putting any hopes on it at all."

Following TI's lead, meanwhile, Atari cut prices for most of its lineup, from the 2600 VCS game console (effectively trimmed to \$59 after a rebate) to the new 600XL and 800XL home computers, given wholesale tags of \$140 and \$240 respectively. Even so, Atari's retail prices were some \$60 above the competition's—the 600XL versus the 99/4A in the 16K arena, and the 800XL versus the Commodore 64. Just as TI disappeared from Montgomery Ward shelves, the 203-store Target chain added Coleco and dropped Atari.

The Warner Communications subsidiary seemed to be pinning its hopes on its AtariSoft line of programs for non-Atari micros, announcing 12 games for the 99/4A and eight for Commodore, IBM, and Apple. In addition to computer versions (expected to retail for \$38 to \$50 apiece), Atari launched several titles for rival Intellivision and ColecoVision game machines.

While VIC-20 sales slowed to a crawl, Commodore 64's were jumping off the shelves. While \$199 prices gave only a \$5 margin over wholesale cost, vendors relied on peripherals and software for

profit. For instance, 90 percent of C64 buyers also choose the 1541 disk drive—supplies of which nearly ran out in late summer, obliging Commodore to schedule an emergency airlift from Japan.

Spinnaker Software President Bill Bowman echoed the industry consensus when he told *InfoWorld*, "If the low end is going to have a savior, it will be the Commodore 64." The only machine that seemed competitive was Radio Shack's white-cased 64K Color Computer, which debuted at \$399.95—well under the C64's original \$595, but twice Commodore's current price. (The compact new Color Computer 2 with 64K RAM and Extended Basic lists for \$468.95, plus upgrade installation.)

How low will Commodore go? In its July 25 issue, *ISO World* claimed that building a C64 costs Commodore less than \$60 and that the firm could "apparently sell the 64 for \$99 wholesale and still make a profit."

While no one seemed ready to tackle Commodore in the trenches, many manufacturers were comfortable in the higher levels of the market. Kaypro was making about 12,000 machines a month, while Apple and IBM each produced perhaps 70,000 IIe's and PC's respectively. Compaq predicted \$100 million in revenues for its first year, selling 50,000 copies of its portable PC clone.

There were rumors of more middle-range micros to compete with Adam

and Peanut—a \$500, 16-bit, 256K Commodore; an under-\$1,000 TI with concurrent CP/M in ROM. Steve Wozniak told the *San Jose Mercury News* that Apple's McIntosh, due in November or December for \$1,200 or so, would "just [boggle] everyone. It's just totally unbelievable and unexpected, not just a better version of something that is already around."

Coleco rebounded from pessimists' gossip to show production units of Adam (though a press release said "less than \$700" instead of the usual \$600 cost figure), and Child World, Markline, and Diners Club joined Wards and Target in placing orders for fall delivery. In mid-September, though, the press reported that Adam's FCC approval would be a month behind

schedule.

Coleco also joined AT&T in plans for "an interactive game and entertainment service," bringing Zaxxon and company to anyone with a home computer or game console. The service will use standard phone lines and an AT&T/Coleco modem; subscribers will pay a monthly charge plus user fees to play a game. The announcement upstaged Mattel, which developed the Playcable service now offered by 20 cable TV companies.

And IBM prepared to upstage everybody, with 100,000 Peanuts sold by Christmas. There was talk of still other news from Big Blue—a portable PC by year's end, a \$10,000, 32-bit challenger to Lisa by spring 1984—but IBM's home computer continued to rule the

gossip world.

Analysts couldn't agree on specifications, *Datamation* reported, but they agreed on one thing: Whether it cost \$700 or \$900, had 64K or 90K, and used a tape drive or a standard 5¼-inch disk or IBM's orphan 3.9-inch disk or CP/M or MS-DOS on a ROM chip, Peanut would use the IBM name to become the dominant force in home computing.

In the words of Peter Cunningham, president of Input, a Mountain View, CA, research firm: "Coleco's Adam might be state of the art for the home market and have the lowest retail price, but it will probably be IBM that makes all the money." ■

—E.G.

PULSE TRAIN

Magic/L challenges Basic

Loki, in Norse mythology, is a malevolent, mischievous god, always making trouble around the gods' home of Asgard and (in Marvel Comics' version) trying to defeat the mighty Thor. If Basic is the Thor of microcomputer languages, Loki Engineering of Cambridge, MA, is hoping to raise a little mischief of its own with a syntax called Magic/L.

According to *Mass High Tech*, Magic/L is "a Forth equivalent with simpler syntax and a high level of interactivity with the user." Its authors, Loki's Jeff Epstein and Arnold Morris, compare it to C and Pascal in terms of structure, but claim it's more powerful and more interactive.

"Magic/L is much faster than Basic, and can be learned in hours," Morris said.



WorkSlate: Designed to do one thing well.

"[It's] the ultimate in user friendly, and once you get good, it allows you to do things like access Assembly language directly."

While working on satellite data display systems at the Smithsonian Astrophysical Laboratory, Epstein recalled,

he and Morris became "frustrated because [Forth] was so hard to read. Forth is what some people call a write-only language." In other words, what looks fine to a Forth programmer might prove baffling to someone who wants to modify the program

later.

In addition, Epstein claims, Forth and other languages "have their roots in prehistory. Basic, for heaven's sake, was written on an IBM 1130, much less of a machine than an Apple."

To overcome these short-

PULSE TRAIN

comings, the two programmers developed Magic/L, working on a Data General Nova in Epstein's basement in early 1981. Today, *Mass High Tech* says, Loki "is betting its future that Magic/L will become a standard language of the 1980s—perhaps even competing head-to-head with Basic in the personal computer market."

After selling it as a development tool for minicomputers, Marketing Manager Barry Unger said, Loki planned to launch CP/M-86 and MS-DOS versions of the new language at Boston's CP/M East show in October, and hoped to make Magic/L a household word before long.

"New languages are usually developed by large teams at universities," Unger said,

"but we believe we have something that is way ahead of anything else, and we see a tremendous growth potential."

Who knows? If Magic/L proves a threat to Microsoft and Digital Research, Loki Engineering may incur the wrath of the gods.

Non-programmable portable

While Tandy's Model 100 and its rivals are lap-sized workstations suitable for almost any computing task, Convergent Technologies Inc., of Santa Clara, CA, has taken a different approach. Its WorkSlate is designed for

specific applications, giving executives a spreadsheet, calculator, terminal, and telephone in an 8½- by 11-inch package.

The 3½-pound portable, introduced in ComputerLand and Businessland stores and in the American Express catalog, has a 16-line, 46-character LCD display, an 8-bit CMOS 6800 CPU, a 300-baud modem, and a built-in microcassette recorder. Its 16K RAM is expandable to 32K, but its strength is its 64K ROM—which includes an advanced spreadsheet and windowing capabilities.

For instance, users can put a spreadsheet at the top of the display and a financial calculator at the bottom, moving data back and forth between the windows.

WorkSlate's audio recorder lets it serve as a speaker-phone and phone-answering machine; spreadsheet templates, called Taskware, are available on special data/voice tapes. Its maker, Convergent's new Advanced Information Systems division, claims users can use the tape recorder to make vocal annotations to spreadsheets, up to 10 of which can be stored on a microcassette.

The firm plans communications, financial-modeling, and memo-writing software—not full-featured programs, but patches or templates to WorkSlate's spreadsheet environment. There may also be different machines for writers and students; Convergent marketing manager Karen Toland admits Work-

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PULSETRAIN

Slate's circular keys discourage typing, but says, "Executives don't type. They do word processing with their mouths."

"WorkSlate is designed to replace the calculator, pencil, paper, and eraser," Toland told *InfoWorld's* John Markoff and David Needle. "It will not compete directly with the Tandy Model 100."

The unit costs \$895, with Taskware tapes selling for \$19.95 to \$49.95 and a printer for \$250.

Small is profitable

Most office automation firms such as DEC, Wang, and IBM hope to place their products with the prestigious Fortune 1,000 companies, whose business totals over \$1.8 trillion in annual revenues. However, according to Focus Research Systems of West Hartford, CT, there's an even bigger market among small businesses. U.S. companies with annual sales of under \$25 million apiece combine for over \$2 trillion a year—and the advent of office micros has made them prime candidates for automation.

American business, Focus points out, consists "of a handful of large companies and a gigantic number of small businesses": of an estimated 3.56 million non-agricultural companies, 3.55 million—99.7 percent—have under 500 employees. Perhaps 3.1 million, or 88 percent of all U.S. businesses, have fewer than 20 people on their payrolls.

Except for a copier (most firms with eight or more employees have a copy machine), these offices stayed unautomated while main-frame and mini salesmen

made their rounds. "A small company with \$200,000 in annual sales may allocate \$4,000 annually for automation, and such a sum hardly warrants a major sales effort by any vendor," Focus' survey, "Small Business Automation," admits.

The microcomputer era changed that. From 1979 to 1982, Focus' survey states, 254,000 small firms bought computers. Of those buyers, 80 percent had 1-19 employees; while only 78,000 firms that size had a computer in 1979, over 278,000 had one three years later.

Looking ahead, Focus predicts over 900,000 small businesses will buy their first computer within the next three years. By 1984-85, the researchers claim, the computer market among companies with under 450 workers will total \$8 billion, with more than half of that coming from firms with under 20.

"Computer vendors with low-cost products and distribution systems capable of selling in volume are well positioned to reap the benefits of this massive market," Focus concludes.

Say it with paper

In a recent "Side Tracks" column (November 1983, p. 6), *80 Micro's* editor-in-chief Eric Maloney remarked that the magazine prefers submissions and queries on paper to messages on CompuServe. The market researchers at International Resource Development Inc. see broader implications, describing an anti-videotex backlash that illustrates Hegelian philosophy.

Proclaiming, "The 'Paperless' Home? According to Hegel, No Way!", IRD

claims that the telecommunications boom will actually increase the consumption of certain kinds of paper—that, with "uniformity, mechanization, and depersonalization" as the thesis, people will long for its antithesis.

"People don't need paper just for business reasons," says IRD researcher Ken Bosomworth. "They need paper for personal reasons, too. A letter written on personalized stationery will be far more meaningful than the same words appearing on a CRT—and, for that matter, more meaningful than the same words printed out on computer paper."

Thus, the Norwalk, CT, analysts predict, the future will bring not one big happy Network Nation but "a resurgence in demand for" high-quality stationery, business forms, and greeting cards, as people seek more sincere correspondence. "And the Hegelian synthesis," IRD concludes, "shall be a world in which the old and new media are each appreciated for the respective strengths they bring to communications."

While rejecting the idea of videotex Valentines, Bosomworth admits that telecommunications will prevail over printed catalogs, directories, and Yellow Pages. "The synthesis-antithesis concept only applies in situations where deeply felt human needs are involved," he says. "If it's a question of efficiencies on the one hand and no emotional need on the other, the efficiencies will win out every time."

CRT users see pink

It seems the debate over possible health effects of

CRT displays will never end. A National Academy of Sciences panel concluded in July that terminal use has no adverse effects on operators' vision, but the National Institute of Occupational Safety and Health (NIOSH) vowed to continue research on health-related CRT problems, including a study focusing on CRTs and pregnancy (see *80 Micro*, October 1983, p. 294).

Now three IBM PC users have discovered that gazing into a computer monitor does indeed have an effect on vision, if not exactly an adverse one. Look at a CRT long enough, and white figures on a black background turn pink.

Susan Greenwald, an Evanston, IL, architect, noticed the color distortion after a session of PC word processing. Greenwald's husband Mark, an ophthalmologist, contacted Randolph Blake, a Northwestern University psychologist who specializes in visual perception. Blake took one look at the CRT and gave a rosy diagnosis: the McCollough effect, a minor optic maladjustment that can last from several minutes to several weeks.

"I routinely explain the McCollough effect in my lecture courses," Blake told *Computerworld*. "The conditions under which the effect is produced have to be fairly constrained. But it just so happens that the green letters on the black terminal generate just this aftereffect."

"The most interesting thing is that the pattern of the color distortion conforms to the pattern and contour of the letters on the screen. That is, if you stare for a long time at a CRT, then see white letters on a black background that are of similar size and shape, you'll get the pinkish tint."

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PULSE TRAIN

While the effect is physiologically harmless, Blake told *CW's* Katherine Hafner, physicians should be aware of it in case computer-owning

patients call, worrying that they've suddenly been struck color-blind.

To former typists or scribes, the McCollough

effect may be a small price to pay for the convenience of word processing ("There aren't really a lot of instances where we read white letters

on black," Blake admitted). If you'd rather see straight, time away from the CRT and keyboard will restore normal color perception. ■

Uncle Sam goes micro

● News flash: The **FEDERAL GOVERNMENT** has discovered that microcomputers are powerful tools, if people know how to use them. Halfway through a six-month study designed to develop policies and plans for federal micro use, the General Services Administration told *Computerworld* that employees find micros help them make decisions faster and complete their work more quickly and accurately.

"In-depth, hands-on training and ongoing availability of technical assistance are essential," the GSA's preliminary findings declare. "Also, formal instruction in software selection and application are essential in managing the successful transition to microcomputer use."

● Radio Shack, continuing its new policy of **COOPERATION** with outside software marketers, has swapped conversion rights with CBS Inc. Tandy earns worldwide rights to market TRS-80 versions of selected CBS programs, while CBS will sell some Radio Shack software for non-Radio Shack micros. The agreement marks the first time Tandy has allowed its software to be converted to other formats.

● As reported in October's End Bytes (p. 300), Tano Corp. of New Orleans, LA, has brought the **DRAGON** to the U.S., one year after its debut in the U.K.—where it's ceased to impress the British magazine *Computer Dealer*. "The Dragon is beginning to look distinctly archaic," writes *CD's* Peter Craig. "Sales figures prove the value of good marketing and distribution over a good product."

Assessing the low-end micro market in Britain, Craig comments that Apple's IIe "still suffers from having the decimal point in its price in the wrong place" and that its "specification is also beginning to look a bit dated," while "the soon-to-be-released Atari models are disappointing evolutions of the old models." Commodore, Craig concludes, is "arrogant in knowing that the 64 is a world beater. The machine is so cheap to manufacture and so superior in performance that Commodore could quite easily zap their competition from a vast altitude."

● From distributing printers and disk boxes, **LEADING EDGE PRODUCTS** has moved into the IBM PC market. The Canton, MA, firm has followed its much-ballyhooed PC word processor with its own MS-DOS micro, an 8088-based system said to run 70 percent faster than the PC and cost 40 percent less. The 128K machine, assembled by a num-

ber of overseas contractors, will be the first hardware product marketed under the Leading Edge name.

● 1983 was the year that computer prices fell through the floor; 1984 may be the year that **SOFTWARE PRICES** follow. Microsoft Vice-President Jim Spillars told *ISO World* in July, "I think you are going to see products in the \$100 to \$150 range by Christmas that have been selling in the \$250 to \$350 price range."

By September, Spillars' prediction seemed on target, with Commodore cutting some C64 software prices 50 percent. Silicon Valley Systems of Belmont, CA, slashed its popular Apple word processor, Word Handler, from \$199 to \$59.95, and offered a package of Word Handler and List Handler, formerly \$298, for \$89.95. It's clear that buyers of the new sub-\$1,000 micros are unwilling to pay \$250 apiece for programs.

● Despite extra courses and upgraded facilities, *The Wall Street Journal* reports, America's **COLLEGES** are falling behind the demand for computer classes. Georgia Tech has had to impose quotas on computer science majors, and the University of Wisconsin at Madison turns away 1,000 would-be computer science students a semester. Those who get in may have to use a terminal located in a hallway outside a crowded classroom, with terminal time available only after midnight.

● The Model 100 is only the beginning: The market researchers at International Resource Development Inc. see **PORTABLES** as accounting for one-quarter of all personal business computers and office workstations by 1987. More and more portables will have integrated voice/data functions like Convergent Technologies' WorkSlate's, that can answer the phone and digitize users' spoken notes as addenda to files or programs; by the late 1980s, "pocket consultants" with optical-card memory should replace "whole shelves of medical or law books" for professionals in those fields.

● The Boston-based analysts of the Yankee Group, meanwhile, see **TELECOMMUNICATIONS** as achieving "mass market status in the fourth quarter of 1985." By then, a Yankee study predicts, 20 percent of home computers and up to 12 percent of video game consoles will have modems, and an additional 1.5 million telephones will sport terminal capabilities and built-in displays.

● And, if all those on-line bomes grow tired of talking to each other, they can turn to The Source and do **CROSS-WORD PUZZLES**. The McLean, VA, data base now offers a weekly British-style (cryptic clues) puzzle, created by New York attorney J. Baxter Newgate. Besides having "instant access to the answers" and being able to challenge or compliment the author, Source puzzlers will soon have the option of choosing different levels of difficulty. ■

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Notes from New England

(Editor's note: With regret and some embarrassment, we must report that the Gamer's Cafe did not submit a column this month. We're not exactly sure why, since Rodney and Mad Max were right here in New Hampshire under our watchful eye. They disappeared mysteriously one day without even a good-bye, leaving behind only a photo of some guy smashing a computer and a disk marked "Misc." That disk contained, among the clutter of half-finished programs and bizarre bits of prose signed "T. DeQuincey" (we suspect that Max wrote them, owing to the many references to the Woodstock Nation and Studebakers), a Scripsit file entitled "Notes," which we suspect comprised the core of the December



column. Those scrawls (and it's not easy to scrawl in Scripsit) are presented here, minus, of course, the many spelling errors and coffee stains.)

Whine, whine, whine! It seems like everybody is accusing everybody else of cheating on Big Board games. We're going to need the Magnificent Seven to

clean up the mess. "It's no fun reading the Big Board mail anymore," says Max.

For starters, Scott Trent challenges Jer McLanahan's 261 in Space Warp. "If you have ever played that game one of the first things you will notice is that the highest possible score is 255," he claims. "The other thing is that it is very

The Big Board

Apple Panic	287,620	Mary Phinney, Stockbridge, MI
Arex	138,780	Rob Mitchell, Peterborough, NH
Assault	97,457	Zagros Sadjadi, Petaluma, CA
Astrobball	317,240	Stefan Kunze, Moers, W. Germany
Attack Force	1,732,820	Dave Smith, Raleigh, NC
Bable Terror	8,857	Mad Max
Barricade	17,520	Troy Scrapchansky, Uncasville, CT
Caterpillar	362,883	Alvah Werner, New Albany, OH
Centipedes	94,836	Belinda Chron, Tempe, AZ
Chicken	12,035	Noble Chowchuech, Demarest, NJ
Clash	174,300	Zagros Sadjadi, Petaluma, CA
Convoy	34,770	Rick Sayre, Stockton, CA
Cosmic Fighter	806,280	Robert Newman, Stoney Creek, Ont.
Crazy Painter	1,087,000	Mike Beebe, Sacramento, CA
Cyborg	317,000	Robert Cavin, Laredo, TX
Danger in Orbit	69,640	Steve Sustacek, Danube, MN
Defense Command	128,230	Bette Dufraigne, Bolton, CT
Demise/Defend	165,000	David Russell, Ardrossan, Scotland
Demon Seed	103,160	Markus Blum, Ludwigshafen, W. Germany
Desert Peril	84,400	Jay McLain, Clatskanie, OR
Devil's Tower	25,700	Rick Sayre, Stockton, CA
Dungeon Escape	6,531	Donald Tindall, Littleton, CO
Flying Saucers	2,186	Stuart Lory, Victoria, B.C.
Fortress	515,925	Greg Samson, Loudonville, NY
Frogger	400,900	Shawn Roberts, Oklahoma City, OK
Galactic Empire	1,850	David Russell, Ardrossan, Scotland
Galaxy Invasion Plus	1,600,058	Shawn Lipman, Nelspruit, S. Africa
Gauntlet	58,360	David Schwartz, San Jose, CA
Ghost Hunter	41,190	John Kane, Nelson, N.Z.
Insect Frenzy	691,156	Tommy Seniuk, Vegreville, Alta.
Invaders from Space	655,360	Darren Cotter, Oceanside, CA
Jovian	148,300	Greg Samson, Loudonville, NY

Jungle Boy	851,900	Zagros Sadjadi, Petaluma, CA
Killer Gorilla	28,312	Alex Poon, Baton Rouge, LA
Laserball	72,530	Neil Matson, Panama City, FL
Laser Defense	1,504,610	Greg Samson, Loudonville, NY
Leaper	144,500	Tommy Seniuk, Vegreville, Alta.
Lunar Lander	15,100	Brent Lewis, Long Valley, NJ
Mad Mines	10,220	Gorman Miller, Titusville, FL
Martian Patrol	30,496	David Schwartz, San Jose, CA
Meteor Mission 2	119,750	Bob Brown, Dallas, TX
Missile Attack	44,000	Raimo Hansen, Mesa, AZ
Monster Invaders	32,620	Troy Scrapchansky, Uncasville, CT
Olympic Decathlon	10,278	Adrie van Geffen, Rotterdam, Netherlands
Outhouse	1,000,000	Kyle Hoyt, Titusville, FL
Panik	85,075	Mark Owens, Houston, TX
Penetrator	585,460	David Schwartz, San Jose, CA
Planetoids	56,450	Carl Pflanzner, Gillette, NJ
Rear Guard	195,240	John Hope, Kingston, Ont.
Robot Attack	143,250	Mark Fertig, Northville, MI
Sea Dragon	610,180*	Robert Fitzwilliam, Houston, TX
Sky Sweep	1,000,540	Tommy Seniuk, Vegreville, Alta.
Space Castle	69,750	Rick Sayre, Stockton, CA
Space Intruders	14,030	Ron Johnston, Emporia, KS
Space Warp (Level 8)	261	Jer McLanahan, New Canaan, CT
Stellar Escort	625,000	Kevin Josephson, Chilliwack, B.C.
Super Nova	2,138,710	Mark Fertig, Northville, MI
Swamp Wars	59,130	Farhad Abrishami, Silver Spring, MD
Temple of Apshai	390	Carl Pflanzner, Gillette, NJ
Time Runner	89,479	Mad Max
Venture	58,550	Darren Cotter, Oceanside, CA
Voyager I	833	Farhad Abrishami, Silver Spring, MD
Weird	61,180	Tommy Seniuk, Vegreville, Alta.
Wild West	15,400	Gorman Miller, Titusville, FL

*Expert mode: 339,080 (David Smith, Kingwood, TX).

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- 2 ANNU11 Annuity computation program
- 3 DATE Time between dates
- 4 DAYYEAR Day of year a particular date falls on
- 5 LEASEINT Interest rate on lease
- 6 BREAKVEN Break-even analysis
- 7 DEPRSL Straightline depreciation
- 8 DEPRSY Sum of the digits depreciation
- 9 DEPRDB Declining balance depreciation
- 10 DEPRDDB Double declining balance depreciation
- 11 TAXDEP Cash flow vs. depreciation tables
- 12 CHECK2 Prints NEBS checks along with daily register
- 13 CHECKBK1 Checkbook maintenance program
- 14 MORTGAGE/A Mortgage amortization table
- 15 MULTMON Computes time needed for money to double, triple, etc.
- 16 SALVAGE Determines salvage value of an investment
- 17 RRVARIN Rate of return on investment with variable inflows
- 18 RRCONST Rate of return on investment with constant inflows
- 19 EFFECT Effective interest rate of a loan
- 20 FVAL Future value of an investment (compound interest)
- 21 PVAL Present value of a future amount
- 22 LOANPAY Amount of payment on a loan
- 23 REGWITH Equal withdrawals from investment to leave 0 over
- 24 SIMPDISK Simple discount analysis
- 25 DATEVAL Equivalent & nonequivalent dated values for oblig.
- 26 ANNUDEF Present value of deferred annuities
- 27 MARKUP % Markup analysis for items
- 28 SINKFUND Sinking fund amortization program
- 29 BONDDVAL Value of a bond
- 30 DEPLET Depletion analysis
- 31 BLACKSH Black Scholes options analysis
- 32 STOCVAL1 Expected return on stock via discounts dividends
- 33 WARVAL Value of a warrant
- 34 BONDDVAL2 Value of a bond
- 35 EPSEST Estimate of future earnings per share for company
- 36 BETAALPH Computes alpha and beta variables for stock
- 37 SHARPE1 Portfolio selection model i.e. what stocks to hold
- 38 OPTWRITE Option writing computations
- 39 RTVAL Value of a right
- 40 EXPVAL Expected value analysis
- 41 BAYES Bayesian decisions
- 42 VALPRINF Value of perfect information
- 43 VALADINF Value of additional information
- 44 UTILITY Derives utility function
- 45 SIMPLEX Linear programming solution by simplex method
- 46 TRANS Transportation method for linear programming
- 47 EOQ Economic order quantity inventory model
- 48 QUEUE1 Single server queuing (waiting line) model
- 49 CVP Cost-volume-profit analysis
- 50 CONDPFROF Conditional profit tables
- 51 OPTLOSS Opportunity loss tables
- 52 FQOQOQ Fixed quantity economic order quantity model
- 53 FQOOWSH As above but with shortages permitted
- 54 FQOQPB As above but with quantity price breaks
- 55 QUEUECB Cost-benefit waiting line analysis
- 56 NCFAFAL Net cash-flow analysis for simple investment
- 57 PROFIND Profitability index of a project
- 58 CAP1 Cap. Asset Pr. Model analysis of project

- 59 WACC Weighted average cost of capital
- 60 COMBAL True rate on loan with compensating bal. required
- 61 DISCBAL True rate on discounted loan
- 62 MERGANAL Merger analysis computations
- 63 FINRAT Financial ratios for a firm
- 64 NPV Net present value of project
- 65 PRINDLAS Laspeyres price index
- 66 PRINDPA Paasche price index
- 67 SEASIND Constructs seasonal quantity indices for company
- 68 TIMETR Time series analysis linear trend
- 69 TIMEMOV Time series analysis moving average trend
- 70 FUPRINF Future price estimation with inflation
- 71 MAILPAC Mailing list system
- 72 LETWRT Letter writing system-links with MAILPAC
- 73 SORT3 Sorts list of names
- 74 LABEL1 Shipping label maker
- 75 LABEL2 Name label maker
- 76 BUSBUD DOME business bookkeeping system
- 77 TIMECLOCK Computes weeks total hours from timeclock info.
- 78 ACCTPAY In memory accounts payable system-storage permitted
- 79 INVOICE Generate invoice on screen and print on printer
- 80 INVENT2 In memory inventory control system
- 81 TELDIR Computerized telephone directory
- 82 TIMULAN Time use analysis
- 83 ASSIGN Use of assignment algorithm for optimal job assign.
- 84 ACCTREC In memory accounts receivable system-storage ok
- 85 TERMSPAY Compares 3 methods of repayment of loans
- 86 PAYNET Computes gross pay required for given net
- 87 SELLPR Computes selling price for given after tax amount
- 88 ARBCOMP Arbitrage computations
- 89 DEPRSF Sinking fund depreciation
- 90 UPSZONE Finds UPS zones from zip code
- 91 ENVELOPE Types envelope including return address
- 92 AUTOEXP Automobile expense analysis
- 93 INSFILE Insurance policy file
- 94 PAYROLL2 In memory payroll system
- 95 DILANAL Dilution analysis
- 96 LOANAFFD Loan amount a borrower can afford
- 97 RENTPRCH Purchase price for rental property
- 98 SALELEAS Sale-leaseback analysis
- 99 RRCONVBD Investor's rate of return on convertible bond
- 100 PORTVAL9 Stock market portfolio storage-valuation program

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The GAMER'S CAFE

hard to play Space Warp if you have other games." Maybe that's why 261 has stood for so long.

Then there's this cranky letter from Greg Samson of Loudonville, NY. He doesn't trust anybody, including the high-score holders for Martian Patrol, Cosmic Fighter, and Robot Attack. And he openly accuses Venture king Darren Cotter's 58,550 of being phony, charging that you can't get any more than 57,500. That Samson is going to be a real popular guy; I hope he can keep his kneecaps intact.

Max says all this cynicism concerning high scores is because of the 1968 Democratic Convention. He walks around the 80 Micro offices shouting, "The whole world is watching! The whole world is watching!"

I was hoping this vacation would do him some good, but I don't know.

The one-line games keep trickling in. Most of them come from Australia,

where the magazine seems to arrive three to five years late. I think I could swim there with a copy in my teeth and beat the overseas mail.

The van finally broke. We've got it down at Roland's Exxon for a tune-up. Max wanted to replace the plugs with pennies, but I think that only works in fuse boxes.

I tore Max away from Convoy long enough to get his opinion on dropping some more scores from the Big Board.

"PURGE," he grunted.

"Dig Out (Y/N/Q)," I said. "Y."

"Paddle Pinball (Y/N/Q)." "Y."

"Scarfman (Y/N/Q)." "Y."

You have to know how to speak Max's language if you want to get through to him.

Confessions of an Honest Gamer: Jack Martin of Somis, CA, sent in a score of 999,970 in Scarfman with the comment, "I feel honor bound to mention that there is a weird mode in Scarfman which enables one to obtain an unlimited number of additional men and that is the way in which these high scores are obtained. Playing with the customary number of men, the highest score obtainable is probably less than 400,000."

Confessions of a Sneaky Kind of Guy: James Griffith of Searcy, AR, reports 910,980 and says, "This score was achieved by a secondary methodology which I prefer not to disclose yet."

"Well, nah-nah to you, too," Max commented snidely.

Today, I found a blueberry on Mount Monadnock the size of a volleyball.

Max is nuts about Computer Shack's Convoy. He particularly likes the suicidal paratroopers. They run backwards into your truck and then explode.

"This is almost as good as a George Romero movie," he keeps saying.

Maybe we should retire Lunar Lander, too.

"In the [September] Gamer's Cafe you stated that the final disgrace will be in the cheating of Lunar Lander," writes Seth Eliot of Brooklyn, NY. Then he proceeds to give instructions on refueling:

On the Model 1, exit the game by pressing Break and Reset, hit Enter at the memory size prompt, type in SYSTEM, and then type in /33767.

"It seems that this memory location refuels you without any damage to the game," writes Seth. "Sorry, Max."

"Not half as sorry as I am," Max grunted.

"It's obvious to me that you have a severe problem with very high scores in the Gamer's Cafe," writes Mark Schmidt. "Why don't you print the scores players get by just using one man?"



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I thought it was an interesting suggestion, but Max was less than excited. "Sure," he said. "Credibility? Verification? No problems."

Shawn Lipman's father called Peterborough twice in one day to report Shawn's Galaxy Invasion Plus score. We don't take high scores over the phone too often (partly because the van doesn't have a phone), but the Lipmans live in Nelspruit, South Africa. Wonder how long it takes the mail to get there?

Max is depressed. First it was the Big Box mail. Then Mary Schmidt of Stockbridge, MI, wrote, "Tell Mad Max to watch out; I'm within a few points of knocking him off his Bable Terror perch."

"Oh, yeah?" Max shouted. "Oh, yeah?"

Finally, to end the week, we were

about to post Max's high score in Convooy when Rick Sayre of Stockton, CA, blew him out with 34,770.

"Oh, yeah?" Max mumbled meekly as he slumped over the keyboard.

The guys at Wally's Hardware in Spencer, MA, sure know how to have a good time.

"These people are *strange*," Max marveled as he looked at a photo of some fellow smashing a Model III with a large hammer.

"When it comes to serious gaming, we employees at Wally's Hardware are real hard-core players," said Bob Noonan in the accompanying letter. "We wring out every point we can get, until the computer screams for mercy."

If they're not playing games, Bob and Dave (the goofy stockboy) are reformatting all of Wally's disks or copying Galaxy Invasion on top of his accounts receivable program.

"Don't tell Wally that Dave cut the cord off the plotter to fix Mrs. Archambeault's lamp, 'cause he didn't feel like wiring in a new cord cap from stock," Bob added, "or that I chopped up his IBM/360 Assembly language textbook to show a customer how a gasoline-powered Weed-Whollop worked."

"These people are *really* strange," Max repeated.

Max is restless. He wants to hit the road again. I've suggested that we go down to Boston to visit Mercedes while she works on her top-secret project at MIT.

The van is fixed. The guy at Roland's called it a miracle. He suggested that we change the oil at least once every 50,000 miles.

I don't know if I'm going to have time to write the December column. Oh, well—I'm sure the people at 80 Micro will figure something out. ■

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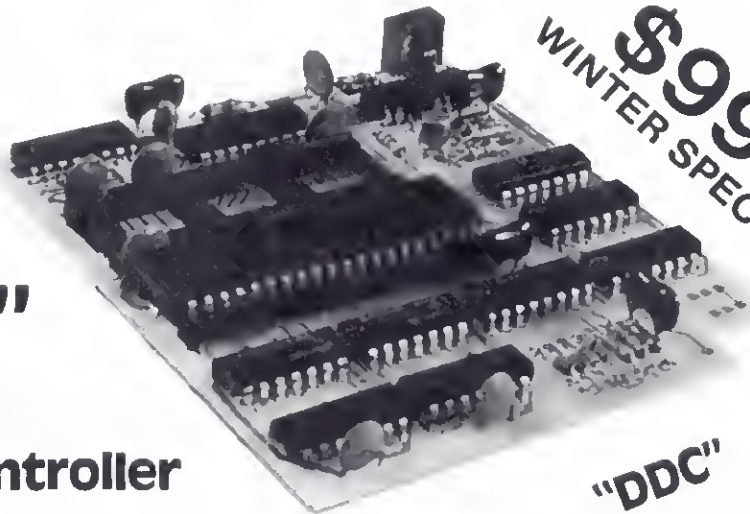
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PERCOM "DOUBLER A"	250	0
LNW "LNDOUBLER"	202	0

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The Christmas Pageant

by Richard Ramella

The best Christmas pageant I ever saw was in the third grade. Icky Vannoy played Santa Claus. A serious actor, he insisted on filling his pillow case sack with real toys. He could hardly lift it.

All he had to do was come

running out when the kids on stage yelled, "Santa is here!" Out he ran from stage left, and the weight of his sack propelled him straight ahead for a quick exit off stage right. He kept going.

Icky went home and didn't

come back to school. Ever. I think he moved to another state during Christmas vacation.

But you're not here to listen to old third grade stories. You want to be in the Fun House Christmas Pageant.

This month I have a secret Yule Greeting program and A Talk with Santa, each with separate Level II and Color listings.

I also have something else. Like Santa, I've been getting letters. Some Fun House visitors don't believe I know how to program in Extended Color Basic. Well, it's not true. I learned how last night and I wrote St. Nick Portrait to prove it.

So far, I've tried to make as many Fun House programs as possible available for as many TRS-80 models as possible. With the introductions of the Model 100 and the Micro Color

```
100 REM * YULE GREETING * TRS-80 LEVEL II BASIC
110 REM * FUN HOUSE * DEC. '83 * RICHARD RAMELLA
120 CLS
130 A=RND(1922)
140 IF A>133 AND A<138 OR A=142 OR A=143 OR A=198 OR A=199 OR A=20
1 OR A=202 OR A=206 OR A=207 OR A=262 OR A=263 GOTO 130
150 IF A=266 OR A=267 OR A=270 OR A=271 OR A>273 AND A<204 OR A=32
6 OR A=327 OR A=331 OR A=332 OR A=334 OR A=335 GOTO 130
160 IF A=338 OR A=339 OR A=346 OR A=347 OR A=390 OR A=391 OR A>395
AND A<400 OR A=402 OR A=403 OR A=410 OR A=411 GOTO 130
170 IF A>413 AND A<424 OR A=466 OR A=467 OR A=474 OR A=475 OR A=47
8 OR A=479 OR A>529 AND A<540 OR A>541 AND A<548 GOTO 130
180 IF A=554 OR A=555 OR A=606 OR A=607 OR A=610 OR A=619 OR A>669
AND A<680 OR A=682 OR A=683 OR A=746 OR A=747 OR A>809 AND A<820
GOTO 130
190 PRINT @ A,CHR$(191);
200 GOTO 130
210 END
```

Yule Greeting—Level II.

```
100 REM * YULE GREETING * TRS-80 COLOR BASIC 4K
110 REM * FUN HOUSE * DEC. '83 * RICHARD RAMELLA
120 CLS(0)
123 GOTO 130
125 PRINT @ A,CHR$(143+40);
130 A=RND(510)
140 IF A=67 OR A=68 OR A=72 OR A=99 OR A=101 OR A=104 OR A=131 O
R A=134 OR A=136 OR A>137 AND A<144 GOTO 125
150 IF A=163 OR A=167 OR A=168 OR A=170 OR A=175 OR A=195 OR A=2
00 OR A=202 OR A=207 OR A>208 AND A<215 GOTO 125
160 IF A=234 OR A=239 OR A=241 OR A>265 AND A<272 OR A>272 AND A
<276 OR A=280 OR A=305 OR A=312 GOTO 125
170 IF A>336 AND A<343 OR A=344 OR A=376 OR A>407 AND A<414 GOTO
125
180 PRINT @ A,CHR$(207);
190 GOTO 130
200 END
```

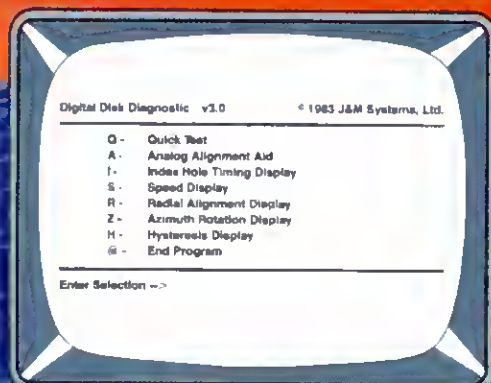
Yule Greeting—Color Basic.

The Key Box

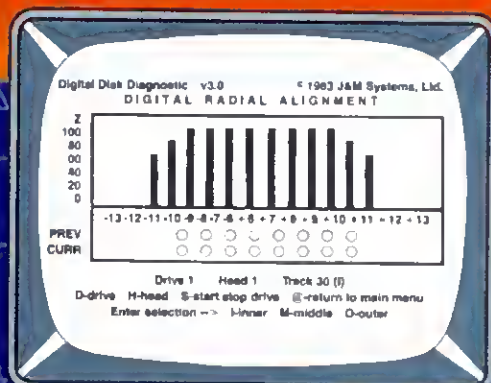
Model I and III
Color Computer
4K RAM
Level II Basic
Color Basic
Extended Basic

DISK DRIVE ANALYSIS PROGRAM

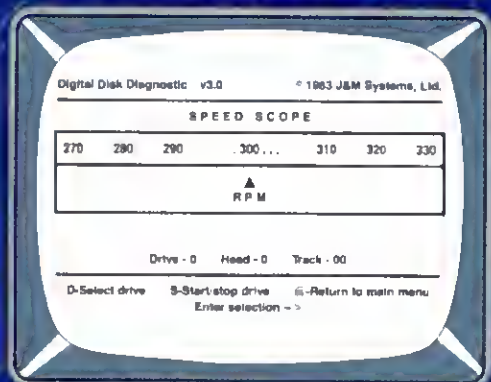
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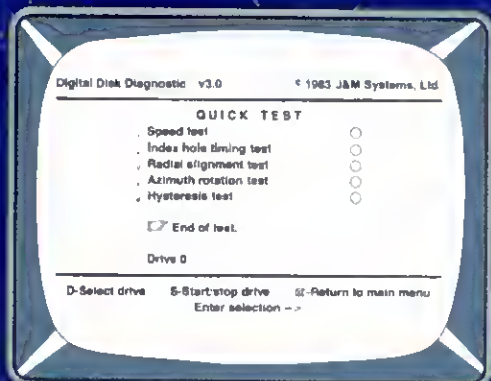
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276 • 80 Micro, December 1983


```

100 REM * A TALK WITH SANTA * TRS-80 LEVEL II BASIC
110 REM * FUN NOUSE * DEC. '83 * RICHARD RAMELLA
120 CLS
130 CLEAR 1000
140 N=0
150 FOR A=1 TO 3
160 PRINT "R";
170 FOR B=1 TO RND(30)
180 PRINT "-I";
190 NEXT B
200 PRINT "NG"
210 FOR T=1 TO RND(1000)
220 NEXT T
230 NEXT A
240 PRINT STRING$(60," ")
250 PRINT "HELLO... THIS IS THE NORTH POLE: LEON THE ELF HERE..."
260 PRINT
270 INPUT "TO WHOM DO YOU WISH TO SPEAK";AS
280 IF LEFT$(AS,5)="SANTA" GOTO 300
290 N=N+1
300 IF N=5 GOTO 350
310 PRINT AS" IS NOT HERE";
320 IF N>1 THEN PRINT " EITHER." ELSE PRINT "."
330 INPUT "ANYONE ELSE YOU MIGHT WANT";AS
340 GOTO 280
350 INPUT "THERE'S A GUY NAMED SANTA CLAUS HERE. WANT TO TALK TO HIM";AS
360 IF LEFT$(AS,1)="Y" GOTO 380
370 PRINT "THEN YOU MUST HAVE A WRONG NUMBER. TOO BAD... IT'S SO NEAR"
380 CLS
390 PRINT "HANG ON. I'LL GO GET HIM."
400 GOSUB 010
410 CLS
420 PRINT @ 400,"HEY SANTA, IT'S FOR YOU."
430 GOSUB 010
440 CLS
450 PRINT "HE WILL BE RIGHT HERE."
460 GOSUB 010
470 CLS
480 GOSUB 010
490 PRINT "HELLO -- HO-HO-HO -- THIS IS SANTA CLAUS SPEAKING."
500 INPUT "WHO IS CALLING ME";AS
510 CLS
520 PRINT "GOOD TO HEAR FROM YOU, "AS". WHERE DO YOU LIVE?"
530 INPUT B$
540 CLS
550 PRINT "MY MY! CALLING ALL THE WAY FROM "B$"!
560 PRINT
570 PRINT AS";, HOW OLD ARE YOU?"
580 INPUT Z
590 IF Z>12 THEN PRINT "AND YOU... ER... STILL BELIEVE IN ME: I'M HAPPY TO HEAR THAT."
600 PRINT "I SUPPOSE YOU WANT TO TELL ME WHAT YOU WANT FOR CHRISTMAS."
610 PRINT
620 N=1
630 INPUT "WHAT WOULD YOU LIKE";C$(N)
640 D=RND(5)
650 IF D=1 PRINT "HMMM... "; ELSE IF D=2 PRINT "I SEE... " ELSE IF D=3 PRINT "SO... "; ELSE IF D=4 PRINT "INTERESTING... "; ELSE PRINT "WELL WELL... ";
660 PRINT C$(N)
670 PRINT
680 N=N+1
690 IF N<6 THEN PRINT "AND NOW... ": GOTO 630
700 CLS
710 PRINT "I MUST GET BACK TO WORK NOW, BUT LET ME RECORD YOUR LIST."
720 GOSUB 010
730 PRINT
740 FOR X=1 TO N-1
750 PRINT C$(X)
760 NEXT X
770 PRINT
780 PRINT "SANTA CLAUS CANNOT EVER PROMISE, BUT I WILL SEE WHAT I CAN DO. GOODBYE TO YOU, "AS"."
790 PRINT "AND VERY HAPPY HOLIDAYS!"
800 END
810 FOR T=1 TO 1000
820 NEXT T
830 RETURN
840 END

```

A Talk with Santa—Level II.

Computer (MC-10), I see it's a losing battle.

As *80 Micro* phases out coverage of the Color Computer, I must do the same. And as *80 Micro* invites CoCo owners to make the switch to sister publication *HOT CoCo*, I'm happy to do the same. For *HOT CoCo* I write a column called Elmer's Arcade, and its arcade games are a mix of Extended Color Basic, Color Basic, and Micro Color Basic.

Now let's go to the auditorium for the Christmas pageant.

Yule Greeting

This greeting has separate listings for Level II and Color Basic. What is the Yule Greeting? It's one word, and that's all I'm saying.

The only instructions for this program are to type RUN and tap the enter key. Then you watch. The secret greeting forms slowly.

If you want to trim the tree while you wait, you have plenty of time. If you want to make this into a game, a group of people can watch. The winner is the first to recognize the greeting.

In Level II Basic, the word is black on a white background. In Color Basic, it's red on a white background.

A Talk with Santa

Again, I have separate Level II and Color Basic listings. Look closely at line 100 to make sure you're entering the one for your computer.

In both versions, the program starts with a ringing telephone. In Color Basic you

A Talk with Santa—Color Basic.

```

100 REM * A TALK WITH SANTA * TRS-80 COLOR BASIC 4K
110 REM * PUN HOUSE * DEC. '83 * RICHARD RAMELLA
120 CLS(0)
130 CLEAR 250
140 DIM B(22)
150 DATA 193,3,193,3,193,6,193,3,193,3,193,6,193,3,204,3,176,3,1
160 FOR A=1 TO 22
170 READ B(A)
180 NEXT A
190 N=0
200 FOR A=1 TO 3
210 FOR B=1 TO RND(15)+10
220 SOUND 215,1
230 NEXT B
240 FOR T=1 TO RND(1000)
250 NEXT T
260 NEXT A
270 CLS
280 PRINT "HELLO, THIS IS THE NORTH POLE. LEON THE ELF HERE."
290 PRINT
300 PRINT "TO WHOM DO YOU WISH TO SPEAK?"
310 INPUT A$
320 IF A$="SANTA" OR A$="SAHTA CLAUS" THEN 440
330 N=N+1
340 IF N=5 GOTO 400
350 PRINT A$ " IS NOT HERE";
360 IF N>1 THEN PRINT " EITHER." ELSE PRINT "."
370 PRINT "ANYONE ELSE YOU MIGHT WANT?"
380 INPUT A$
390 GOTO 320
400 PRINT "THERE'S A GUY NAMED SAHTA CLAUS HERE. WANT TO TALK TO
HIM?"
410 INPUT A$
420 IF LEFT$(A$,1)="Y" GOTO 440
430 PRINT "THEN YOU MUST HAVE A WRONG          NUMBER. TOO BAD... IT
'S SO NEAR CHRISTMAS...": END
440 CLS
450 PRINT "BANG ON. I'LL GO GET HIM:"
460 GOSUB 920
470 CLS
480 PRINT @ 400,"HEY SANTA, IT'S FOR YOU!";
490 GOSUB 920
500 CLS
510 PRINT "HE WILL BE RIGHT HERE."
520 GOSUB 920
530 FOR A=1 TO 21 STEP 2
540 SOUND B(A),B(A+1)
550 NEXT A
560 CLS
570 GOSUB 920
580 PRINT "BELLO -- HO-HO-HO -- THIS IS          SAHTA CLAUS SPEAKING.
"
590 INPUT "WHO IS CALLING ME";A$
600 CLS
610 PRINT "GOOD TO HEAR FROM YOU,"
620 PRINT A$". WHERE DO YOU LIVE?"
630 INPUT B$
640 CLS
650 PRINT "MY MY! CALLING ALL THE WAY"
660 PRINT "FROM ";B$
670 PRINT
680 PRINT A$", HOW OLD ARE YOU?"
690 INPUT Z
700 IF Z>16 THEN PRINT "AND YOU... ER... STILL BELIEVE IN ME. I
'M VERY HAPPY TO HEAR THAT."
710 PRINT "I SUPPOSE YOU WANT TO TELL ME   WHAT YOU WISH FOR CHR
ISTMAS."
720 PRINT
730 N=1
740 INPUT "WHAT WOULD YOU LIKE";C$(N)
750 D=RND(5)
760 IF D=1 THEN PRINT "HMMM "; ELSE IF D=2 THEN PRINT "I SEE...
"; ELSE IF D=3 THEN PRINT "SO... "; ELSE IF D=4 THEN PRINT "INTE
RESTING... "; ELSE IF D=5 THEN PRINT "WELL... ";
770 PRINT C$(N)
780 PRINT
790 N=N+1
800 IF N<6 THEN PRINT "AND NOW... ": GOTO 740
810 CLS
820 PRINT "I MUST GET BACK TO WORK NOW, BUT LET ME RECORD YOUR L
IST."
830 GOSUB 920

```

Listing continued



hear the ring, but in Level II Basic you see the word R-I-I-ING! a few times. Then an elf named Leon answers the phone at the North Pole and asks you to whom you wish to speak.

If you don't know who to ask for after spending all that money on a long-distance call to the North Pole at Christmas time, I'm afraid this program ends.

If you reach the right North Pole personality (S***a C***s), you get to tell him your Christmas wish list.

St. Nick Portrait

This part of the big yule show is only for people with Extended Color Basic machines. It draws a picture of Santa Claus. It's a fairly good likeness, although I can't draw hands.

And there's more. You see Santa drawn on the screen and you have a few moments to admire his pudgy form. Then a green text screen appears that asks you to wait a moment.

Behold, on comes a picture of Leon, who had a brief speaking part in A Talk with Santa. In this program he gets a nice closeup but has no lines to speak.

Listing continued

```

840 PRINT
850 FOR X=1 TO N-1
860 PRINT CS(X)
870 NEXT
880 PRINT
890 PRINT "SANTA CANNOT EVER PROMISE, BUT IWILL SEE WHAT I CAN D
O. GOODBYE TO YOU, "AS"."
900 PRINT "AND VERY HAPPY HOLIDAYS!"
910 END
920 FOR T=1 TO 1000
930 NEXT T
940 RETURN
950 END

```

```

100 REM * ST. NICK PORTRAIT * TRS-80 EXTENDED COLOR BASIC
110 REM * FUN HOUSE * DEC. '03 * RICHARD RAMELLA
120 PCLS
130 PMOOE1,1
140 SCREEN 2,I
150 CIRCLE(120,96),40,,1.5
160 CIRCLE(141,155),15,,1.5
170 CIRCLE(116,155),15,,1.5
180 CIRCLE(160,60),30,,,4
190 CIRCLE(100,60),30,,,4
200 LINE(110,134)-(135,164),PRESET
210 LINE(135,164)-(135,100),PRESET
220 LINE(00,60)-(166,60),PRESET
230 PAINT(129,96),4,4
240 CIRCLE(129,60),20,3,2
250 PAINT(120,60),1,3
260 FOR Y=20 TO 40
270 LINE(112,Y)-(146,Y),PRESET
280 NEXT Y
290 CIRCLE(120,35),25,3,.8
300 FOR X=112 TO 145 STEP 4
310 LINE(X,40)-(X,60),PRESET
320 NEXT X
330 CIRCLE(120,56),6,6,.5,.0,.5
340 LINE(126,40)-(130,46),PSET,BP
350 LINE(110,22)-(150,27),PSET
360 LINE(160,0)-(110,22),PSET
370 LINE(160,0)-(150,27),PSET
380 PAINT(125,20),4,4
390 CIRCLE(122,34),6,,,6,.5,1
400 FOR X=122 TO 124
410 PSET(X,36,3)
420 PSET(X+11,36,3)
430 NEXT X
440 CIRCLE(135,34),6,,,6,.5,1
450 CIRCLE(72,60),0,3
460 CIRCLE(100,60),0,3
470 PAINT(74,60),5,3
480 PAINT(100,60),5,3
490 FOR Y=100 TO 116
500 CIRCLE(120,Y),40,3,.5,1,.5
510 NEXT Y
520 FOR Y=111 TO 115
530 CIRCLE(120,Y),30,5,.5,1,.5
540 NEXT
550 FOR Y=170 TO 190
560 CIRCLE(114,Y),0,3
570 CIRCLE(142,Y),0,3
580 NEXT
590 FOR X=95 TO 112
600 CIRCLE(X,190),7,3
610 CIRCLE(X+40,Y),7,3
620 NEXT X
630 CIRCLE(163,3),4,3
640 FOR T=1 TO 5000
650 NEXT T
660 CLS
670 PMDDE 4,1

680 PRINT "WAIT JUST A MOMENT MORE AND YOU WILL SEE ONE OF SANTA
'S ELVES... LEON."
690 LINE(0,96)-(255,191),PSET,BP
700 FOR T=1 TO 1000
710 NEXT T
720 SCREEN1,I
730 GOTO 730
740 END

```

St. Nick Portrait.

FUN HOUSE

If you want to see only Santa and not Leon, put a new line (655 GOTO 655) into the program.

Next month is 1984. I wonder how many days each of us has been alive. We'll try to figure that out an easy way. Next month's programs will work on any TRS-80 model. ■

Do you have a question about a Fun House program? Write me, Richard Ramella, 1493 Mt. View Ave., Chico, CA 95926. You must include a 20-cent stamped, self-addressed envelope. From other countries, send a self-addressed envelope and your nation's coin equal to postage.

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SPOOL-Z-Q

Spool-Z-Q accepts characters at computer speed and feeds them to your printer at its much slower speed. This eliminates the time you waste waiting for your printer to finish before you can use your computer.

FEATURES

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FEEDBACK LOOP

by Terry Kepner



Send any questions or problems dealing with any area of TRS-80 microcomputing to Feedback Loop, 80 Micro, 80 Pine St., Peterborough, NH 03458.

The July 1983 column had three letters concerning problems with the Smith-Corona TPI and SuperScript. I, too, have a TPI printer, as well as a DMP-2100.

I tried the DW2 driver and had the same difficulties as the other people. Using your ideas, I located the place in the DW2 driver program where initialization occurs, address BE0F hexadecimal (hex).

Instead of using an editor/assembler to change the code, I used the F function (file patch utility) of Debug on my Model III disk system. The procedure is: Enter Debug at the TRSDOS READY prompt, press the F key, enter DW2/CTL for the file specification, page through the file until line number 3F00 appears on the screen, press the M key, place the cursor over the byte at 3F03 (19), enter 00 and press the enter key, and exit Debug.

I enjoy 80 Micro very much. I am a relative newcomer to computing and appreciate the hints and advice in your column.

W.C.
Tampa, FL

Thanks for the modification instructions and your kind comments. For a "relative newcomer" you sound as if you're doing pretty well.

First, I would like to add CP/M to my 48K single-disk Model I. Where can I get the hardware and software to do this, and how hard is it to do?

Second, I want to add a modem to my computer. Since I don't have an RS-232 board, where can I get one? Or should I buy a modem with a built-in RS-232? And could I use the RS-232 for other purposes if I did this? Is there a local CompuServe number in the Champaign/Urbana, IL area?

And finally, what have you heard about the new Banana printer from Leading Edge Products? At \$249.95 it sounds like a good buy.

T.D.
Mascoutah, IL

Several dealers sell CP/M upgrades for the Model I computer. For a list of them, see last month's column. All are fairly simple to install.

If you want a Radio Shack RS-232 board for your computer, you can still buy one from Radio Shack. If your local R/S doesn't have any in stock, you can buy one from Rider Radio in Peterborough, NH 03458. The problem with the Radio Shack unit is that it tends to make poor contact with the expansion interface (EI) main circuit board and is prone to glitching while in use. Several weeks ago mine started having problems and ended up getting me thrown off the CompuServe network three times in 15 minutes. The only real solution to the poor contact problem is to solder the RS-232 to the EI connection (not a job for amateurs).

Getting a combination RS-232/modem unit for your computer would make it easier to use and would eliminate most of the contact problems (especially if you use Gold-Plug 80s on the EI extension port). The disadvantage is that the RS-232 ends up being dedicated to the purpose, although at least one manufacturer gives you an extra edge connection for the RS-232.

Your final choice is to buy an external RS-232 board that plugs into the expansion port of the RS-232. This is the most common approach used by people unwilling to put up with the Radio Shack RS-232.

Both of the last two choices have one problem; they don't use the same address ports as the R/S board and this causes some difficulties finding software. If you decide to buy an outside

RS-232 board, check with the manufacturer about which software will or won't work with their board.

I've heard nothing about Leading Edge's Banana printer except that it's available. The September 80 Micro has some information in the New Products section (p. 349).

What jumper changes are required when upgrading a Model III or 4 with 64K to 128K?

T.K.
Julian, CA

You don't need any jumpers. You must replace the DIP (dual inline package) shunt in socket U72 with a Programmable Logic Array (PLA). The ones used by Radio Shack are made by Monolithic Memories Inc., and are called PALs (a registered trademark).

The PLA used with the Model 4 comes with the 128K upgrade kit. I have no information on the serial number or specifications of Radio Shack's PAL.

We just purchased a new Model 4, and I want to know if anyone has written any drivers to use the 80-column screen and 4 MHz clock speed with Model III programs? I currently have DOSPLUS 3.5 for the Model III but am unaware of any drivers or patches to use the Model 4 features.

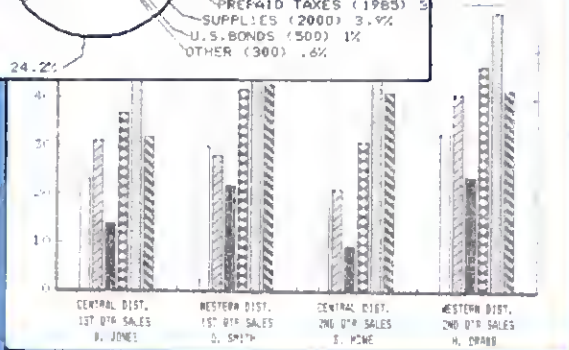
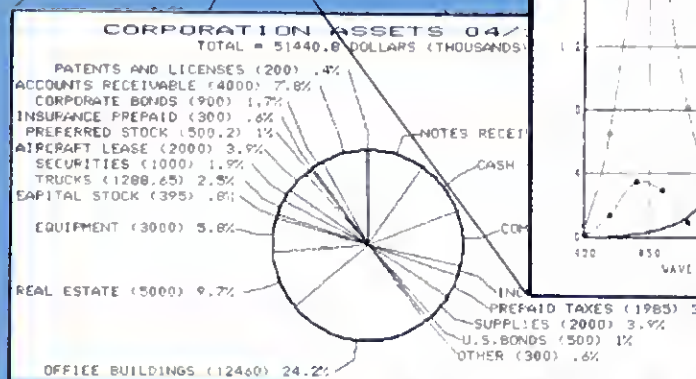
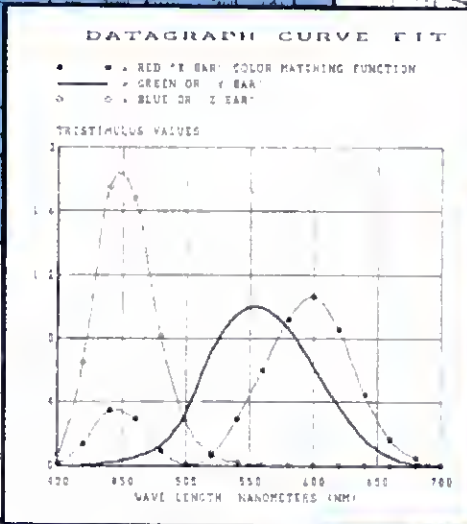
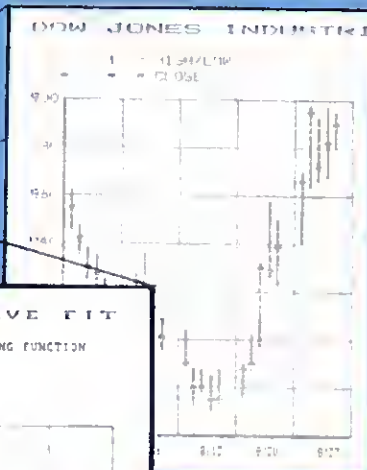
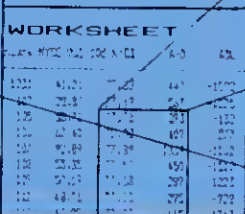
Second, I'm going to be writing some estimating programs on the Model 4 requiring continuous calculations and comparisons with large indexed numeric data files. I want to know what languages you feel best suit my needs. I'm using Basic, but it's time-consuming and the file handling is too complex.

J.R.F.
Huntington Beach, CA

No one has as yet written a driver to use the Model 4 features in the Model III mode, but it won't be long before the DOS manufacturers have fixed their DOSes to optionally use those features.

PRINTER GRAPHICS PROGRAM

ELECTRONIC WORKSHEET									
January 5	WTC	STG	BOT	GO	SEP 500	GOVERNMENT	DEPT	GOVERNMENT	GOVERNMENT
1220	71.00	943.00	370.15	114.42	130.76	130.6	570	74.53	13.65
1225	70.75	877.75	121.40	115.51	125.71	130.2	495	71.87	9.65
1230	70.50	802.50	4.00	116.50	120.70	129.8	432	69.21	11.68
1235	70.25	727.25	43.80	117.49	115.62	129.4	369	66.54	13.79
1240	70.00	652.00	70.10	118.48	110.56	129.0	306	63.88	15.89
1245	69.75	576.75	136.40	119.47	105.50	128.6	243	61.21	17.99
1250	69.50	501.50	202.70	120.46	100.44	128.2	180	58.55	19.99
1255	69.25	426.25	269.00	121.45	95.38	127.8	117	55.88	21.99
1300	69.00	351.00	335.30	122.44	90.32	127.4	54	53.22	23.99
1305	68.75	275.75	401.60	123.43	85.26	127.0	0	50.55	25.99
1310	68.50	200.50	467.90	124.42	80.20	126.6	0	47.89	27.99
1315	68.25	125.25	534.20	125.41	75.14	126.2	0	45.22	29.99
1320	68.00	50.00	600.50	126.40	70.08	125.8	0	42.56	31.99
1325	67.75	0	666.80	127.39	65.02	125.4	0	39.89	33.99
1330	67.50	0	733.10	128.38	60.00	125.0	0	37.23	35.99
1335	67.25	0	799.40	129.37	55.00	124.6	0	34.56	37.99
1340	67.00	0	865.70	130.36	50.00	124.2	0	31.90	39.99
1345	66.75	0	932.00	131.35	45.00	123.8	0	29.23	41.99
1350	66.50	0	998.30	132.34	40.00	123.4	0	26.57	43.99
1355	66.25	0	1064.60	133.33	35.00	123.0	0	23.90	45.99
1400	66.00	0	1130.90	134.32	30.00	122.6	0	21.24	47.99
1405	65.75	0	1197.20	135.31	25.00	122.2	0	18.57	49.99
1410	65.50	0	1263.50	136.30	20.00	121.8	0	15.91	51.99
1415	65.25	0	1329.80	137.29	15.00	121.4	0	13.24	53.99
1420	65.00	0	1396.10	138.28	10.00	121.0	0	10.58	55.99
1425	64.75	0	1462.40	139.27	5.00	120.6	0	7.91	57.99
1430	64.50	0	1528.70	140.26	0	120.2	0	5.25	59.99
1435	64.25	0	1595.00	141.25	0	119.8	0	2.58	61.99
1440	64.00	0	1661.30	142.24	0	119.4	0	0	63.99
1445	63.75	0	1727.60	143.23	0	119.0	0	0	65.99
1450	63.50	0	1793.90	144.22	0	118.6	0	0	67.99
1455	63.25	0	1860.20	145.21	0	118.2	0	0	69.99
1500	63.00	0	1926.50	146.20	0	117.8	0	0	71.99
1505	62.75	0	1992.80	147.19	0	117.4	0	0	73.99
1510	62.50	0	2059.10	148.18	0	117.0	0	0	75.99
1515	62.25	0	2125.40	149.17	0	116.6	0	0	77.99
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I know it's possible because Holmes Engineering has several DOSes patched to use their 80-column board upgrade for the Model III. Once the DOSes are ready, the Basic programs can easily use the features and software will be developed that takes advantage of the Model 4 options in the Model III mode.

Languages are always a problem. Cobol was designed for business, and is used to manipulate large numeric arrays as in inventories and data bases, but its I/O routines are as weak as Basic's. Fortran was designed as a scientific language for extremely fast and accurate numeric calculations. Basic was intended as a good beginner's language, with good string handling capabilities (Cobol and Fortran's weak points), moderate calculation accuracy, and easy-to-program I/O routines (which become complex as they get larger).

If you want a fast calculating language and I/O routines that you can customize and optimize for speed, I suggest you investigate Forth. Forth is a bit unusual in that it is totally flexible. As a Forth programmer you can define new Forth commands to do whatever you want done, much like defining a new Basic command in Basic. For example, you could define a command to clear the screen, load the next record into memory, and display it on the video by assigning a name to the sequence of Forth commands that do the same action.

Forth uses a syntax that's radically different from all other languages, but it's highly efficient. This syntax difference is the most difficult part of learning Forth. A page of Forth commands (defined as one display screen) looks like a scrambled-code message. One common complaint is that a few days or weeks after writing Forth code, not even the programmer can figure out exactly what he did.

Once you learn Forth, you'll love it for its programming ease. If the command isn't there, just define your own new command. In fact, asking a Forth aficionado how to do something (such as writing a custom disk I/O routine) can be frustrating because he'll usually tell you to just write it. Currently, the best Forth available for the TRS-80 computer is from Miller Microcomputer Services (61 Lake Shore Road, Natick, MA 01760, 617-653-6136, \$129.95).

I have a Model I with an LNW Expansion Interface and a Teac disk drive. On power-up, the disk comes on for about three seconds and then shuts off. Reset doesn't do anything differently. After the drive shuts off, the keyboard goes dead and I get no response.

I checked all the connectors, solder joints, proper parts in sockets, etc., and everything seems in order. Now what?

K.T.
Salem, NH

I need more information. Does the unit work as a 16K Level II machine? Does the unit work as a Level II machine with the interface attached and turned on? Does the interface have memory? If it does, can you get it in Level II mode (does it power-up as a 32K or 48K machine)? If there's no memory in the interface, are you sure your DOS will operate in only 16K? Some DOSes require a minimum of 32K to work right. What DOS are you using? Have you called or written the LNW trouble desk for help? Is your interface a kit you built, or did you buy it?

If you get full memory from the interface and the computer works fine as a Level II machine, something is wrong with the disk drive controller circuitry or with the disk drive itself. Find someone who has a working Model I disk system and use your keyboard on it. If it works, your keyboard unit is OK. Have your friend use your drive on his system. If it works, the problem is not with the drive. If the keyboard unit and the disk drive test out OK, the trouble is with the interface.

As you know, the PRINT #1 instruction on the Model III is very slow because it always writes the header first. I would like to know if there's a buffer I can fill before writing to cassette. I know the Color Computer PRINT #1 works like that.

I also want to upgrade my system to 32K. I bought one 4116 chip and inserted it in my computer as you described in your column. It didn't work; I still get 15314 as the memory available. Does the computer read blocks of 16K, or is the chip bad?

I need a good memory map of my computer, can you recommend a good book?

J.P.
Berchem, Belgium

The design of the cassette I/O routines of the Model III and Color Computers are totally different. The only way you'll get the Model III to buffer cassette I/O in the manner of the Color Computer is to write your own machine-language cassette routines.

You upgrade the memory of all the microcomputers made by Radio Shack (except their pocket computers) in blocks of 16K. The computers address each chip in the 8-chip block as 16K by 1 bit. Installing only one chip activates only 1 bit of the 8-bit words in the 16K block. To upgrade, you must use all eight chips.

Soft Sector Marketing sells the book *Model III ROM Disassembled*, which includes a memory map of the machine.

I read D.J.'s question concerning the installation of new characters in the Model I character generator (August 1983, p. 316). Enclosed with this letter is some literature on a character generator ROM that I manufacture. Note that besides having true lowercase descenders, you can also program the ROM to contain a second character set custom designed by the user.

T.W.
Bainbridge Is., WA

Now that's an interesting development. According to the literature, the EC-1 is a pin-for-pin replacement ROM for the MC M6670 used by the Model I as a character generator. In addition to replacing the TRS-80 character set with one containing true descenders, the EC-1 has room for a complete alternate character set. The characters are 5 by 8 matrices, so you can custom design any character you want.

If you want to use the alternate character set and the normal set, you can install a toggle switch to let you pick the one you want. Or you can fix the ROM to use only one of the two sets available. The EC-1 is also inexpensive, retailing at \$11. If you want a custom character set, the EC-1 costs \$19.

Of course, to use the upper-/lower-case generator, you'll have to have modified the video RAM so that it displays the additional characters. You can do this easily by soldering a 2102 RAM on top of the video RAM chip, as explained in the April 1981 issue of *80 Micro*.

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I ran the MEMTEST program that came with TRSDOS on my computer. The checksums for the A and B ROMs were OK, but the ROM C checksum was different from the ones listed for it. My Model III ROM C has a checksum of 2F84. Is there a reason for concern about the difference? My computer has worked flawlessly since I bought it.

L.L.
Bronx, NY

Worry not, the latest ROM C has the checksum you have. It's just that the program is an older version and doesn't have all the correct checksums for the ROM C versions available. Happy computing.

I'm confused about the sound routines for the Model III computer. I would like some information about the way people work with them. I've tried to put their routines on the end of my programs and all I get is a Cass? prompt.

I tried to modify the Memory Size?, PEEK, and POKE. I also tried four different kinds of sound routines; they all work as long as the routine is by itself. Does it have anything to do with POKE 16526,n and POKE 16527,n?

T.R.W.
Southern Pines, NC

There are several things that could be wrong. First, where are these sound routines going in memory? If they're located at a particular place in memory, moving them around will make them malfunction. If the routines reside at the top of memory, only one can be there at a time without fouling up the others.

If a given routine is located at the top of memory, you have to use the Memory Size? prompt to protect the routine from being stepped on by Basic when it tries to run your program. You also have to tell Basic that there is a machine-language routine located at the top of memory, and that you want to use the routine. This is done with the two POKEs you mention. These place the address of your sound routine in a location reserved by Basic for the USR function, which passes control from a

Basic program to a machine-language program and back.

So, if you want to use the sound routines in your programs, you first have to determine where the routines are located. If more than one routine is located there, you have to make sure that the routines don't overlap, or you'll ruin one or all of them. Similarly, cassette-based systems support only one USR function at a time, so if you have several routines, you'll have to develop a method to switch between the routines when you call the USR routine (perhaps use a GOSUB, before the USR command, to jump to lines that POKE the starting address of the particular routine you want into the USR address location).

Start with a routine that you know works; modify the program to do what you want. If it no longer works, you'll have to contact the author for more information on what the routine does and how to modify it. If it does work, start on the next routine.

I have a 48K Model I with three disk drives and a Model 33 teletype for a printer. I have also acquired another Model I, which is a 16K Level I computer. I intend to upgrade it to Level II, and have it as a spare CPU for the first computer.

Can I hook up the two units so that I can control the main unit with the spare? I'd like to have the spare keyboard and monitor upstairs in the livingroom so I can write code, letters, or whatever. I'd also like to be able to load programs into the main unit, alter them, and then save the results on disk. I have an interface that lets me turn the printer on and off without commands.

As I see it, the new keyboard will control the old computer, printer, and drives, and the new monitor will report what's happening. I have no need for the paths to be reversed.

J.C.
Wayne, NJ

In other words, you want to be able to make the older computer a slave to the new one.

The only method I know of for such an application requires the use of RS-232 boards. You load a host terminal program that treats all RS-232 incoming data as if it were typed on the

computer's keyboard. All video display is simultaneously echoed out the RS-232. The other computer would have a terminal program loaded in memory that simply sends every keystroke to the RS-232 and takes incoming data and places it on the video display. Nothing is stored or kept in the remote computer's memory, except the program itself.

This method works the way you want. The disadvantage to this system is that you'd have to load the terminal program into the remote machine by cassette tape, and load the host program from disk. Every time you wanted to use the entire system, you'd have to make sure the host computer has the host program in memory and runs correctly before loading and using the remote computer.

If you wanted to get fancy, you could buy BBS software for your disk computer and leave the computer permanently turned on. Whenever you wanted to use the system, just call it up with the remote program (go on-line with the RS-232 terminal program) and start using your computer. Or leave the BBS on drive zero with Auto engaged to load and execute the BBS program. Then you would just have to turn the computer on when you want to use it.

The disadvantage to this system is that you have to buy the additional hardware for the two RS-232 boards, and run an RS-232 cable between the two machines (maximum length without an intermediate amplifier is about 25 feet). For your remote computer, you would have to buy a non-Tandy RS-232 board that lets you attach directly to the keyboard unit without an expansion interface. The disk-based computer would likewise require a non-Tandy board (if you want reliable operation for long periods of time).

I have a strange problem that I hope you can help me with. I have a 48K, dual-disk Model I computer that randomly reboots when in Disk Basic. The computer works fine in DOS, Level II Basic, and when running machine-language programs. I have cleaned all the connectors and resoldered everything that looked flakey. I'm using NEWDOS80, but I'm sure that isn't the problem.

G.S.
Danbury, CT

You didn't mention the age of your computer. If you have one of the older expansion interfaces, you may need to have it modified for increased reliability. The first step is to use the buffered cable; the EI-to-CPU cable has a black box in the middle of it. This helps stabilize the data line and makes it more resistant to electrical noise. If the problem persists, you have to direct-wire the RAS, CAS, and MUX lines inside the keyboard and EI units, from the origination points to the edgcard connections.

If you still have problems, you have to make the pregnant cable (MUX) modification. The three previously mentioned bus lines are cut from the EI-CPU cable and placed in a separate, twisted wire pairs, DIN cable. This cable has a male and female six-pin DIN connector in the middle to let you unplug the CPU unit from the EI unit (hence the bulging, pregnant look to the cable).

These modifications are required on most old model expansion interfaces, which were poorly designed. If you already have these modifications, remove the two power supplies from the EI case; the fluctuations of the magnetic fields induce interference with your EI RAM chips. If you're still having problems, check the FDC chip for poor connection to the circuit board.

I would like to learn Assembly language, but all I know is that it's faster than Basic. I have the book Inside Level II, but I don't understand it. Please tell me the best way I can learn about Model I Level II Assembly language, without having to spend lots of money.

T.K.K.
Chico, CA

First, the Model I computer is a Z80 CPU-based computer, so any book teaching the theory of Z80 programming will help you. However, I suggest that you get either *TRS-80 Assembly Language Programming* (Radio Shack #62-2006, \$3.95) by William Barden, or *TRS-80 Assembly Language* (Prentice-Hall, Englewood Cliffs, NJ 07632, \$9.95) by Hubert S. Howe Jr. Both books deal specifically with the Model I. Howe's book is easier to understand, while Barden's book gives instructions

on using Radio Shack's T-Bug and Editor/Assembler.

A year ago, I purchased a Microtek Byewriter-I and their interface board for my Model I. Everything worked fine until I added the chips for 48K operation. Level II recognizes the full 48K when first powered up, but after a variable time the computer reboots to the Memory Size? prompt, or some other apparently random spot.

I thought the problem was interference until I discovered that responding to Memory Size? with 32767 or less prevents the problem while still allowing machine code to run in high RAM. What's up?

K.H.
Livermore, CA

Basic stores program variables, arrays, and program operation tables starting at the top of RAM and working down. You use the top 2 bytes constantly. Since the dividing address between the keyboard unit and the expansion memory is 32767, your difficulty is with the high 32K RAM bank.

First, make sure that the connection between the keyboard unit and the expansion box is clean and solid (use isopropyl alcohol and cotton swabs to clean off the dirt, and a pink rubber eraser to remove any tarnish off of the cable contact; the connectors should fit tightly).

If the problem persists, try swapping the top 16K bank with the memory in the keyboard. Next, check to see if the R/S black box power supplies are too close to the memory or the interconnecting cable. And finally, is the RAM and printer circuitry being driven by the keyboard's power supply? If so, the interconnecting cable could be interfering with itself, although that's not too likely. What's more likely, if the expansion unit uses the keyboard power supply, is that the added memory is overtaxing the power supply and causing your trouble. In this case you'll have to get a separate power supply for the expansion box.

If the problem still doesn't go away, contact the manufacturer of your expansion box and ask for help.

I have a 48K, three-drive Model I with the Radio Shack doubler installed.

My problem is with TRSDOS 2.7DD. When attempting to copy from single-density to double-density, TRSDOS 2.7DD won't read anything above track 35 on the single-density disk.

It appears that this problem could be corrected by a very simple patch, but Fort Worth won't say when or if the patch will be available, nor will they release the file specification, password, sector location, or any other data on how to access TRSDOS 2.7DD.

Do you know of a patch for this problem, or must I start looking for a new double-density DOS?

R.K.
Clovis, NM

You'd better start looking, because I don't have that patch in my bag of tricks. Can anyone else help?

My 48K, single-disk Model I has several problems: spontaneous disk reboots, inability to reboot a disk using the keyboard reset button, DOS message CANNOT BOOT or something similar while the disk spins in the drive, and occasional screwy behavior while using VisiCalc (i.e., the left arrow key moves the cursor down one line).

Just recently I had to replace the keyboard-CPU cable to get the computer to function as a 16K computer.

I can feel a slight wiggling of the connector at the EI—perhaps the original Radio Shack plug is getting old (I tried replacing the keyboard-CPU cable, but got no improvement). Right now, I haven't had a reboot since I started this letter. Apparently if I get the cable connectors just right, proper contact is made and no rebooting occurs.

I'm thinking of soldering the EI and CPU together with a 40-conductor cable, but feel I might regret it later on. Now what should I do?

S.D.
East Lyme, CT

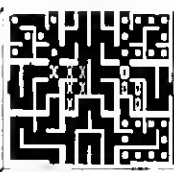
Things are never simple. First, the keyboard-CPU cable is a very weak point in the system. When you get strange results after typing on the keyboard, this cable connection is almost always the problem. This cable can also cause spontaneous system reboots, and prevent proper disk-booting action.

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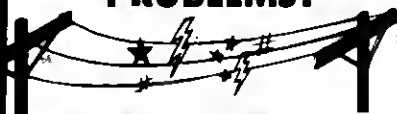
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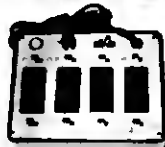
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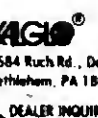
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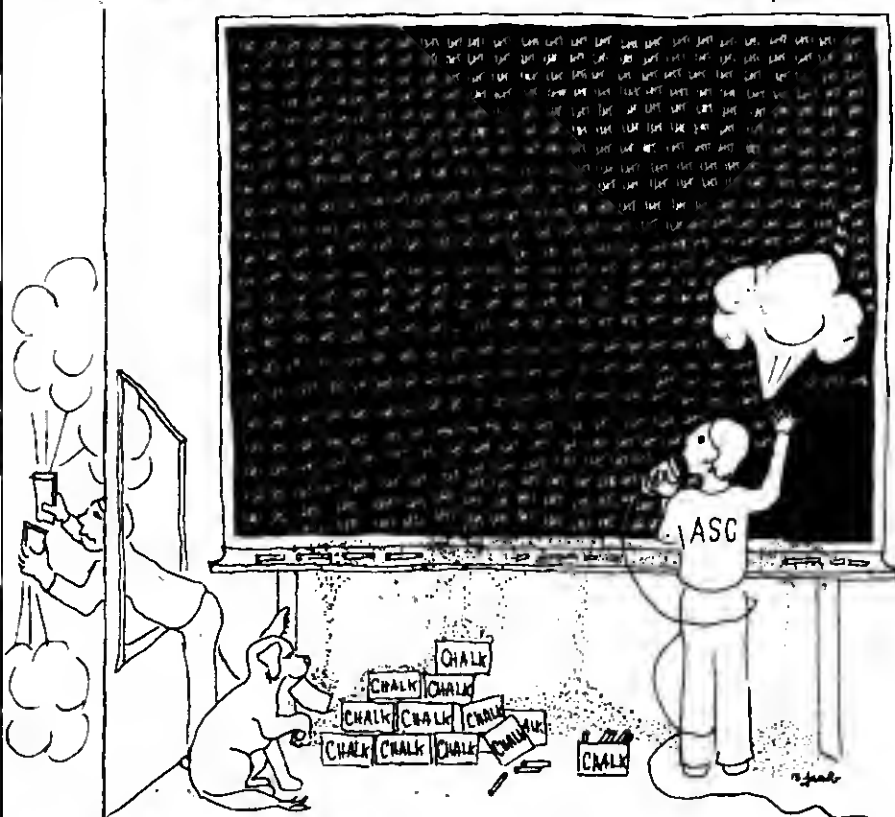
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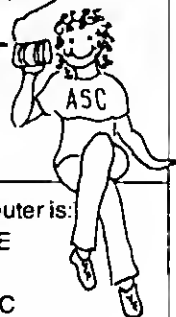
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FEEDBACK LOOP

Check it carefully for lifted traces on the edgecard, cold solder joints, or intermittent solder bridges.

Next, check the power connectors where your power supplies attach to the circuit boards; they may be loose and causing reboots. Also, check and clean the contacts on the FDC chip in the EI (that's right, clean the FDC chip pins).

The disk booting problem has several possible sources: The edgecard connection to the disk drives may need cleaning, the disk drive logic card's edge connector may need cleaning, the head may need a slight realignment and cleaning, or the motor speed may need adjusting.

Start with the easiest: clean the edgecard connectors, then use a disk drive cleaner for the head (or alcohol and long cotton swabs).

The reset button sounds as if it's broken. As a Level II machine, does Reset work? It may also be suffering from cold solder joints, lifted traces, and other mechanical problems. Let me know if you're successful in correcting the problem.

I have a problem with my Model I speed-up kit. My system comprises: Model I (board #1700069D, Satellite ROMs, 16K RAM from Exatron, Cerdal's The Patch, Programma 80-Grafix board, and Exatron Speedup Kit); Radio Shack Expansion Interface (board #1700077D, 32K RAM from Exatron, Percom Doubler II); Aerocomp's 80-track disk drive (MP1 91); Exatron Stringy Floppy; Epson MX-80 printer; and DBLDOS from Percom.

I bought the keyboard in 1978 as a Level I machine. When Level II was released, I ordered it the next day. The same goes for the expansion interface, which works fine without a buffered cable or other reliability modifications.

Everything worked fine until I increased memory to 32K (the speed-up kit supports 50 and 100 percent speed increases, both of which function fine in a 16K system). When I try to use the system with 48K, the 50 percent mode works for everything except machine-language programs; the 100 percent mode locks up everything.

Is there a way to have the expansion interface support the high speed operation? Exatron suggested replacing the CPU with a Z80A, and said I might have slow memory. I removed the memory from the expansion interface and tried it in the keyboard. Everything

worked fine, so slow memory can't be the problem.

I borrowed a copy of Tandy's Dynamic Memory Test program from a friend and ran it at normal speed with no problems. At the 50 percent speed increase, everything checked out until the 16K/32K boundary, when the system crashed. The 100 percent speed increase immediately locked up the computer.

P.L.

Lawrence, KS

Yes, you can make the expansion interface operate at high speed. You have several points where problems could foul up your high-speed modification. First is the memory. The expansion interface is much more critical of timing constraints than the keyboard unit. Remember, the expansion interface is farther away from the CPU than the keyboard RAM.

Electrons in metal move at about 3×10^{10} centimeters per second. There are 1×10^9 nanoseconds (ns) in a second. So in one nanosecond, the electrons move about 30 centimeters (almost 12 inches). This may not seem like much, but if you're using RAM rated at 250 ns (time required to respond to a signal from the address bus and put the addressed byte's data on the bus) in the EI, the added distance may be just enough to cause problems.

In other words, RAM that performs flawlessly in the keyboard can fail in the expansion interface. You can see the same problem occur at normal speed by using 400 ns memory in the EI instead of the standard Radio Shack 300 ns memory.

Furthermore, at 3.54 MHz, each clock pulse defines a 282 ns window. If you slow down the signal too much by the address-decoding integrated circuits (ICs) and support chips, the RAM won't get the information on the data bus until it's too late.

The best solution is to use the fastest memory possible; 150 ns is great, 100 ns is the best (but very hard to find, and expensive). That takes care of memory.

Remember that the Model I was an experiment, designed for the tinkerer. It wasn't designed for clock speeds of over 1.77 MHz. This means that the digital components weren't designed for faster speeds either. That is, the units can't respond to the orders from the CPU fast enough to deliver or process the re-

quired information within the amount of time allocated by the clock frequency. Result: system lockups.

Some of the components are capable of operating at 5 MHz, but many begin to fall behind the CPU at that speed. Even some Z80 CPUs can't operate at the higher speed and have to be replaced. And for the EI, the greater distance to the EI, plus the additional memory-decoding ICs, can make the difference between high speed operation or a locked up computer.

Also, you say you don't have any of the EI reliability modifications. Well, Radio Shack didn't come up with those modifications for the fun of it. They were developed as a solution to the common complaint of Model I owners about EI memory problems. The reason you've never had to make the modifications is that you didn't have the memory in the EI to cause the problems. All the modifications were made to correct memory problems. If I were you, I would seriously consider having those modifications made.

If you want better explanations about speed-up problems, and instructions on what you can do to correct them, call Holmes Engineering. ■

Terry Kepner is a freelance writer and programmer, and the vice president of Interpro. He's been writing about microcomputers since 1979.

Frequently Needed Numbers

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With every turn of its drives, your computer's floppy disk controller (FDC) is on the lookout for errors. The Cyclic Redundancy Check (CRC) safeguards the accuracy of your data by performing a quick calculation on a full sector of data. The CRC byte, the expected solution to the CRC calculation, is just one kind of information encoded on your disk by the disk drive.

To help you better understand how this works, I'll explain disk drive and disk technology. Demystifying the disk operating system's cosmos may make your computing life a little happier.

The Disk Drive

A disk drive does three things: it spins a disk, positions a read/write mechanism, and communicates with the floppy disk controller (FDC) chip. When these processes happen correctly, your computer reads from or writes to your disk. It's something we take for granted until an error message appears on the screen.

Your stomach turns, you pound the reset button praying that it isn't so, and you begin to wonder just what HIT the table or where that sector could have gone. The real question is just what is the drive doing wrong?

Spinning the disk is technology with which everyone who owns a record player is familiar—a motor turns a platter on which you place a disk. Your disk drive spins at 300 rotations per minute (rpm), a speed that could make The Beatles sound like mosquitos. Just as a speed variation on your turntable makes your records sound bad, a speed variation on your drive means bad disk input/output (I/O).

While most manuals suggest that a speed deviation of plus or minus 5 percent is permissible, I get nervous at anything greater than plus or minus 1.5 percent. By the time you've got a 5 percent deviation, you'll also notice plenty of disk I/O problems. Many programs are available that measure the drive's spin speed. Owning one is vital for diagnostic purposes, although actually adjusting the speed requires the derring-do to try open heart surgery on your computer (thus voiding your warranty) and infinite patience. I suggest you let a professional do it.

A stepper motor (stepper motors move discrete distances one step at a

The heartbreak of CRC errors

time) positions the read/write head. Locating and relocating the tracks on your disk depends on the accuracy with which the stepper motor moves the read/write head. Like the tone arm on your turntable, the stepper motor can position the read/write head to 'play' any track; unlike a record player, the read/write head, as the name implies, also records data onto the disk.

If your disk I/O problems are unpredictable, that is they come and go, watch for a pattern. Does the computer read and write fine when you turn it on but become undependable after it's been working awhile? Suspect your head alignment. A head that's marginally aligned may read fine when you first turn on the computer, but as the machine heats up, the alignment shifts. Again, the easiest solution is taking it to a professional.

Information exists on a disk in the form of magnetic pulses. The head reads more magnetically positive bits as logical ones, the less positive bits as logical zeros. The read/write head picks up

these bits in a series, that is, one after another. The Z80 microprocessor at the heart of your TRS-80 computer reads information 8 bits at a time, a method known as parallel. One of the FDC's jobs is collecting the serial input and sending it to the Z80 in parallel.

The FDC navigates the disk by first using the index hole and then using markers written on the disk by the disk operating system (DOS). The FDC looks for two kinds of markers, sector headers and clock bits. Both are written when you format a disk.

The Disk

When you look at a disk, a few things are apparent. First, a floppy disk is made of two parts, one sandwiched inside the other. The inside is a shiny, metal-oxide-coated, circular piece of mylar plastic (the disk) that slides freely inside the square piece of plastic (the shell) that envelops it. Six asymmetrical holes are cut into the disk's shell.

The large hole in the center gives the disk drive a place to grab the disk. To spin the disk in its shell, stick two fingers through the center hole, spread them to apply pressure to the inside rim of the disk, and turn. Do not touch the disk's surface! A small hole in the disk will appear in the round window to the right of the center hole. This is the index hole, which the FDC uses as the absolute landmark of its location on the disk.

The two small half circles punched in the bottom of the disk are alignment notches. They help insure that the disk is set securely in the drive. The square notch cut into the side of the disk is the write-protect notch. If this notch is filled in (by taping a label over it), the FDC will not let the read/write head write on that disk. To get your computer to write on a write-protected disk, remove the label.

The oval window cut at the bottom of the disk's shell is the place where your drive reads the disk. When you see how small this head access window is, you appreciate how finely tuned the disk drive is. It adjusts the read/write head to find between 35-40 (and on some drives 80) separate positions (tracks) in an area less than 1½ inches long!

The disks you're familiar with are soft-sectored, which means that the

TRSDOS Model I		
5	sectors	= 1 gran
2	grans	= 1 track
10	sectors	= 1 track

TRSDOS Model III		
3	sectors	= 1 gran
6	grans	= 1 track
18	sectors	= 1 track

DOSPLUS Model III		
6	sectors	= 1 gran
3	grans	= 1 track
18	sectors	= 1 track

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Table. Some examples of different track allocations.



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space on their surfaces is partitioned by the DOS software, rather than through a "hard," or permanent, manufacturing process. Because the sectors aren't created in the manufacturing process, DOS designers can divide the disk space arbitrarily.

The DOS

The smallest unit of information a DOS reads or writes is called a sector. Sectors are clumped together as granules or grans, and grans are gathered into tracks. Different DOSes use different patterns of space allocation; some divide a track into two grans with 10 sectors per gran, another uses three grans of six sectors per track. This is why some DOSes can't read disks written by other DOSes. (See the Table for some examples of common DOS allocations.)

Information contained in a sector is of two types, the information you write (data) and the information the DOS writes (sector header). System information includes an identifying address mark (a sort of flag saying "Here's some location information"), the track number, the sector number, the sector length, and the CRC bytes. Combined, this information creates a heading for your data that lets the computer retrieve it when you need it.

In addition to these sector headers, the DOS writes another kind of marker on the disk. Called clock bits because they're written by the FDC's 1 MHz

clock, they create spaces between them that hold data. They are, in a sense, the cartoon; your pieces of data are the eggs.

Using the index hole on the disk, the FDC finds the beginning of a track. Using the clock bits, the FDC locates the spaces where the data resides. When it reads an I.D. address mark (the number FE hexadecimal coming after a gap), the FDC knows it has found a sector. Reading the sector header tells it what track and sector it has found. A lot of space on your disk is taken up just defining and identifying the space you wish to use.

Every time it reads a sector, the FDC comes across 2 bytes of information that are directly related to the accuracy of its last write. These are the CRC bytes. Their value, as mentioned earlier, is determined by a calculation performed on the value of all the other sector bytes. When the FDC reads a sector, it performs this calculation on the data it has just read.

If the value matches the value of the CRC byte on the disk, all's well. If the values don't match, the computer prints an error message on the screen and quits. Depending on the software controlling the disk I/O, the error message says either "CRC error" or "parity error." Either way, it's bad news.

Utilities are available that might straighten out a problem disk: Debug on TRSDOS, SuperZap on NEW-DOS80, and Super Utility Plus, to name a few. But honestly, the best medicine

for any disk problem is preventive.

Preventive Medicine for Your Disks

Make a back-up copy of every important disk! At 80 Micro, we use only third-generation copies of our DOSes. The original sat in the disk drive long enough to make a copy of itself, our working master. The working master comes out of its envelope only to create a back-up, the copy we actually use. This policy sounds neurotic—until somebody does one of those ten thousand things that trash disks. But, when that happens, we don't get stuck sitting around waiting for the manufacturer to replace our disk.

The same holds true for data disks; unless you love typing, keep up-to-date back-ups on your data files. It takes time, but ten minutes a week now may save you hours trying to reconstruct a blown disk later.

The rule to remember is, if it doesn't have a back-up, it will develop an error. Back up your disks!

The second great preventive measure is to keep your drives well maintained. Invest in a diagnostic disk and test your drives once a month. If the disk speed varies more than 5 rpm in either direction (faster or slower), get it fixed before it causes problems.

Buy a disk drive cleaning kit and use it. Dirt on your read/write head acts like sandpaper on your disk, an undesirable condition.

Finally, a reminder of stuff you already know. Open and close your disk drive's door gently. If you slam it around day in and day out, it will break. Since the door is part of the mechanism that holds your disk in place, a loose or crooked door will result in disk I/O errors. In a worst-case scenario, a door off its hinges renders the drive inoperable.

Store your disks in their envelopes, away from dust and magnets. Remember, the telephone and the speaker in your cassette recorder have magnets. Keep your disks away from them. The top of your video display screen is also a bad place for disks. It generates enough radio frequency interference to garble your disks.

Your disk drive, disks, and DOS work together in a complex system designed to guard against errors, but, as with any sophisticated technology, it requires care on your part to keep it working. ■

Article	Page	Cassette File Spec	Disk File Spec	Comments
Side A				
Channels of Communication	140	A	TITLE/BAS	Basic
Chameleon Code	170	B	SATCOM/BAS	Basic
Assembly-Language Disk I/O	88	C	CONVERT/BAS	Basic
Real World Control—Part I	152	DISKIO/CMD	DISKIO/CMD	System
Real World Control—Part II	152	†	CMDTBL/SRC	EDTASM*
Real World Control—Part II	152	†	ALARM/SRC	EDTASM
Real World Control—Part II	152	†	CLOCK/SRC	EDTASM
Side B				
Real World Control—Part II	152	CMDTBL/CMD	CMDTBL/CMD	System
Real World Control—Part II	152	SPRINK/CMD	SPRINK/CMD	System
Real World Control—Part II	152	ALARM/CMD	ALARM/CMD	System
Real World Control—Part II	152	CLOCK/CMD	CLOCK/CMD	System
Real World Control—Part II	152	†	SPRINK/SRC	EDTASM

†Source code not available on cassette.

*EDTASM is a trademark of Radio Shack.

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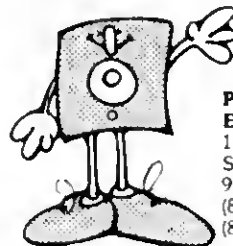
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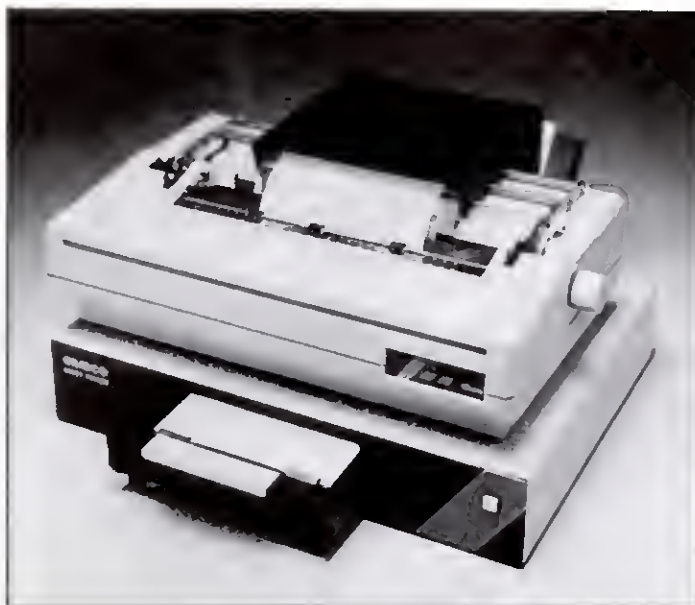
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Cassette Sheet Feeder

A unique over-the-top sheet feeder for daisy wheel and matrix line computer printers is being sold by Gradco Systems Inc., 3421 West Segerstrom Ave., Santa Ana, CA 92704, 714-549-9175.

The unit features a single-cassette, 500-sheet capacity feeder. To operate, place the loaded cassette under the printer, and when printing begins, paper automatically feeds over the top of the printer directly into the printer's platen. The mechanism is completely enclosed, with no frames or holders located above the printer's profile to obstruct your view.

The feeder accommodates a wide range of paper sizes and envelopes, as well as business forms, and automatic stacks of printed material. You can easily change from sheet to fan-fold feeding. An indicator light and button located at the front of the unit provide auto-stop and jam-release functions.

You can install this over-the-top sheet feeder on many printers, including those from C. Itoh, Diablo, Qume, NEC, and Brother, among

others. Pricing ranges from \$600-\$700 depending on your printer model.

Reader Service ✓ 551

Hamming Around

All you ham operators out there can now receive and transmit Morse code on your Model 1, III, or 4 with this software-only Morse Code Interface. This 12K machine-language program has special routines that check incoming signals to make sure that they are valid code and not noise. Bursts of noise are ignored and only valid code is processed and displayed on the video screen.

Another routine lets you view the incoming signal to aid in optimizing the receiver control settings. The program samples the received code bits and automatically adjusts them to the proper speed.

The transmitter mode features five programmable buffers (200 characters total), a type-ahead (working buffer), and user-selectable sending speeds up to 70 words per minute.

Comp-Code 1.0 costs just \$26.95 from Gary Woodall Software, P.O. Box 284,

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Reader Service ✓ 579

Project Planning Program

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A key feature of this program is the resource scheduling (levelling and limiting) component that allows different schedules based on resource requirements and availability. In addition, you can generate progress out of

sequence that can be undone if necessary.

Plantrac operates under TRSDOS 2.0 on the Models 11, 12, and 16. It costs \$3,000 from Computerline Limited, 755 Southern Artery, Quincy, MA 02169, 617-773-0001.

Reader Service ✓ 562

Floppy Pockettes

If you've been stuffing your notes concerning a particular disk in an envelope, or have written cryptic notes on the disk label only to have them smear the next day, Floppy Pockettes may be of some use to you. With these special vinyl disk envelopes, you can store a 3- by 5-inch card in the clear pocket, giving you plenty of room for notes.

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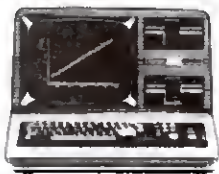
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Reader Service ✓ 559

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Reader Service ✓ 561

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Reader Service ✓ 568

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Minuteman: An emergency power supply and voltage regulator.

NEW PRODUCTS

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Reader Service ✓ 563

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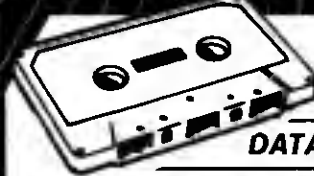
Priced at \$795 for the single-board configuration and \$995 for the complete enclosure, the Micro Matrix II is sold by Digital Laboratories Inc., 600 Pleasant St., Watertown, MA 02172, 617-924-1680.

Reader Service ✓ 565

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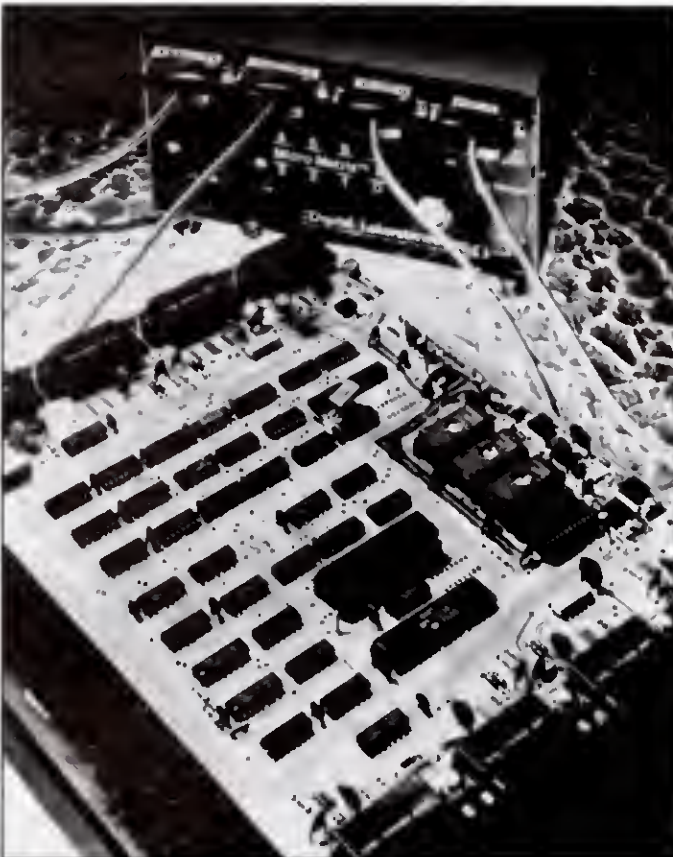
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late to a specific holiday or event. Their unique feature is that you can order them custom-programmed. An individual lucky enough to receive a bitCard as a gift will find several personal references to himself as he proceeds through the adventure (e.g., his name found on a note uncovered in a locked drawer).

BitCards also deliver a personal holiday greeting to your friend(s) in whatever words you wish. Your message appears as part of a dazzling climactic animated graphics scene—the reward for successfully completing the adventure (impatient players can jump to this final scene by using a password).

Available for the Models 1, III, and Color Computer, bitCards cost \$16.95 each from bitCards, 120 South University Drive, Suite F, Plantation, FL 33317, 305-473-4741. BitCards are available for Christmas, Valentine's Day, birthdays, graduations, and other holidays and milestone occasions.

Reader Service ✓ 556

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216-464-7252.

Reader Service ✓ 558

Model 100 Memory

The IM-100 is an 8K RAM memory module that plugs directly into the existing sockets of your Model 100 with no modifications to the system. You can add up to three of these plug-in modules to upgrade the portable computer to a total of 32K RAM memory.

Each memory module sells for \$75. If you buy two or more units, the price is reduced to \$70 each. For further information, contact Holmes Engineering, 5175 Green Pine Drive, Murray, UT 84107, 801-261-5652.

Reader Service ✓ 554

Raiders of the Lost Pyramid

An adventurer, you are looking for the hidden buried entrance to a pyramid that holds priceless treasures hidden for thousands of years. Your only tools are a crude map (a cube with ancient markings), a partial hieroglyphics dictionary, and a special navigation box. After you discover the entrance, you'll meander through rooms and chambers filled with one death trap after another. You are to unravel all the mysteries of this ancient pyramid and find all the treasures. The catch? Get out alive!

Infidel is the newest prose adventure game from Infocom. Its realistic environment is a result of the research the adventure's author did on pyramids and Egyptian history. The game features Interlogic, a development system that lets you use complete sentences instead of the standard two-word commands. Infidel recognizes a 600-word vocabulary, so you shouldn't have much trouble communicating.

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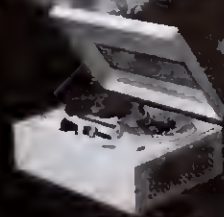
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Reader Service ✓ 555

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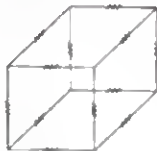
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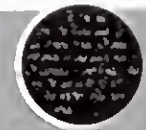
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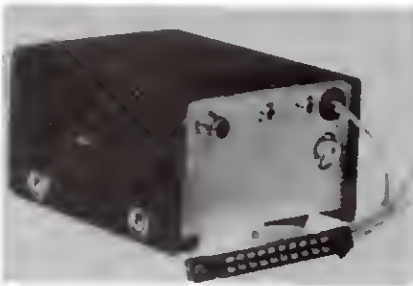
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Reader Service ✓ 576

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Dancing Sailors is the dual-pen version of the DMP-40 plotter from Houston Instruments. It enables you to generate two-color plots or plots using different line widths without having to intervene. A simple command directs the plotter to place the alternate pen in plotting position. Since both pens are carriage mounted, pen changes are fast and easy.

The DMP-40-2 plotter costs \$895 from Houston Instruments, 8500 Cameron Road, Austin, TX 78753, 512-835-0900, 800-531-5479. Both RS-232 and Centronics

parallel versions are available.

Reader Service ✓ 581

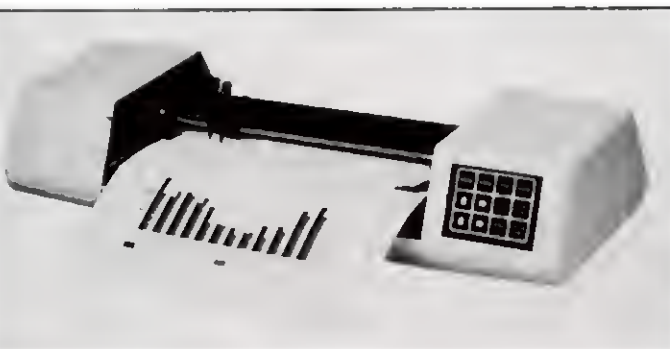
Let's Draw

Creative-Art is an advanced utility to design graphics on your Model III. The program has over 25 commands to let you draw circles, lines between points, rectangles, frames, and a single-key screen invert. Other commands include filling in and erasing parts of the screen, storing the screen in one of five pages of memory and displaying them later.

The program also handles text. An alphanumeric mode lets you place text anywhere on the screen. This is helpful when you generate reports and graphs. You can store screens on either cassette or disk. The package includes a sample program to retrieve the screen from disk or cassette for use with your own program.

Creative-Art is available for the Model III for 16K, 32K, and 48K cassette systems, and for 32K and 48K disk systems. Both the 32K and 48K versions store more pages and handle more points. All versions cost \$30 for cassette and \$40 for disk. Contact Creative Software Enterprises, Route 1, Box 222-A, Ana, IL 62906, 618-833-7797. All registered owners receive free updates for one year.

Reader Service ✓ 577



The Dancing Sailors Plotter gives you two-color plots.

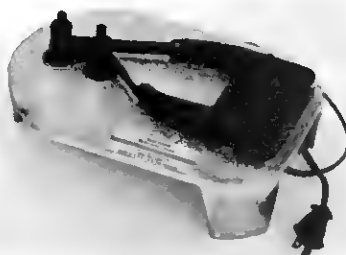
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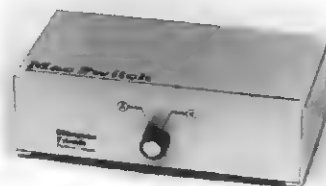
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Some potential applications for Brainstormer include increasing flexible thinking, discovering new products, targeting new markets, and exploring organizational problems. Brainstormer is available for Models 1, III, and 4. It costs \$50 for a single machine, \$100 for 2-10 machines used by a single organization. For information, contact Soft Path Systems, c/o Cheshire House, 105 North Adams, Eugene, OR 97402, 503-342-3439.

Reader Service ✓ 567

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The VID-80 board retails for \$279.50, and the CP/M 2.2 operating system sells for an additional \$120. Other op-

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Reader Service ✓ 552

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Reader Service ✓ 553

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Continued on p. 316

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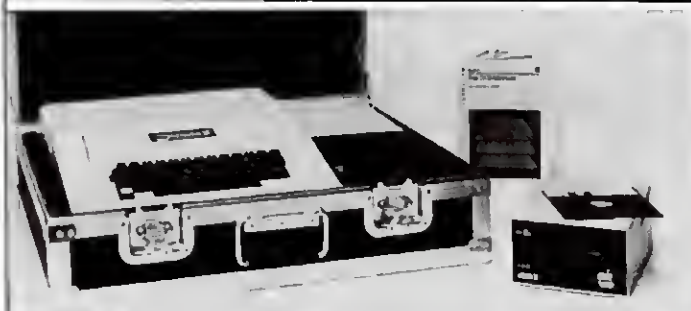


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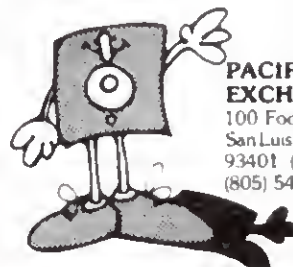
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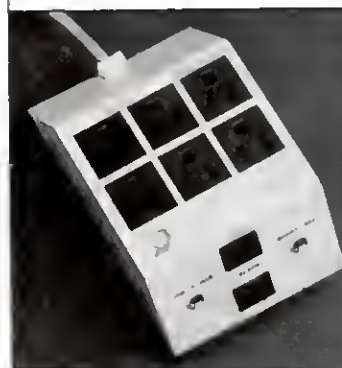
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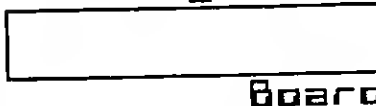
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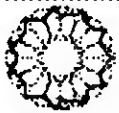
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Surface Plot automatically removes hidden lines for best results. You can save finished plots on disk or print them on any of 20 popular printers. The program requires the use of Grafyx Solution in order to work (Grafyx Solution is a plug-in, clip-on board that gives you 98,304 points in a 512 by 192 matrix).

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This well-rounded word-processing system is available for the Models II, 12, and 16 operating under CP/M. It requires 64K of RAM and costs just \$69.95 before Christmas, \$99.95 afterwards. For more information, contact Harris Micro Computers Inc., 2560 North 560 East St., Provo, UT 84604, 801-373-1605.

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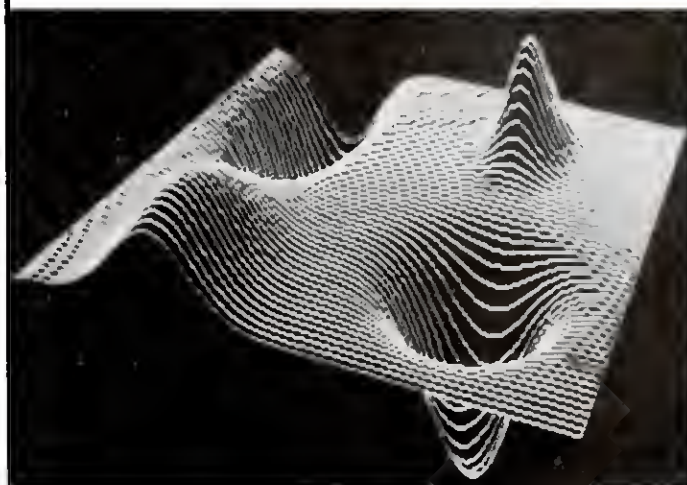
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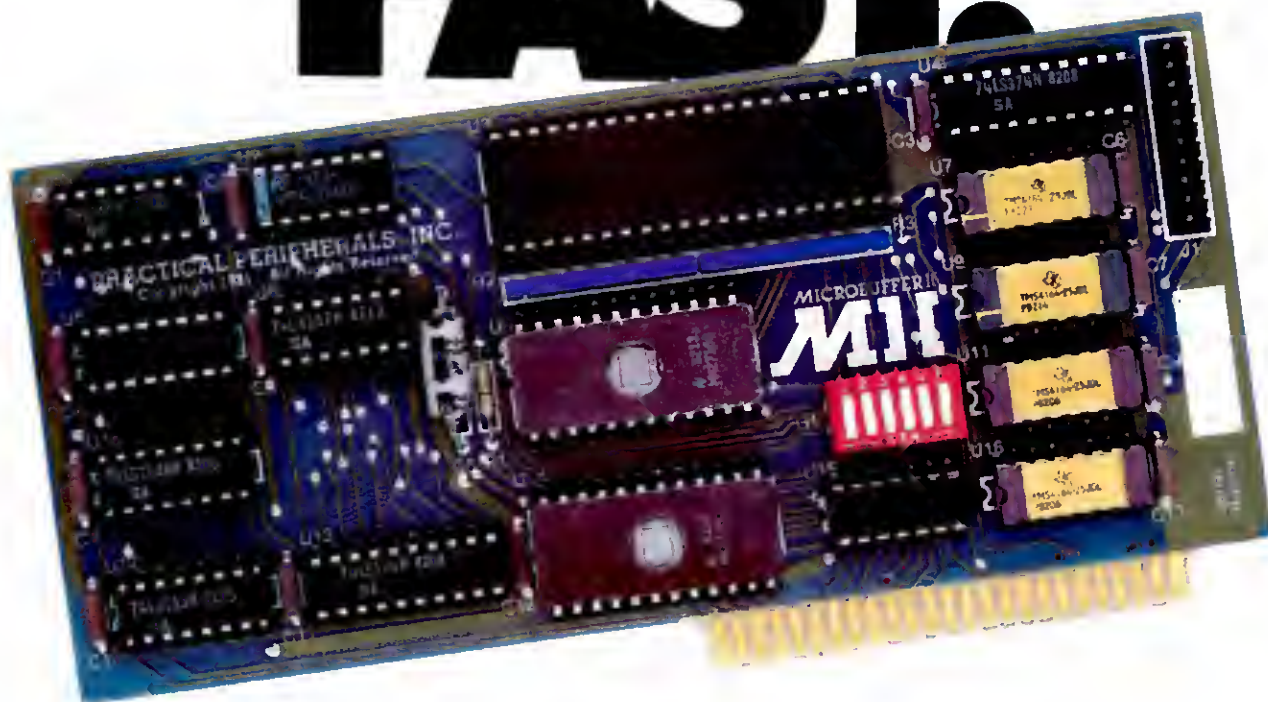
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